ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated Electrical Contracting, The Electragist and Electrical Record...Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

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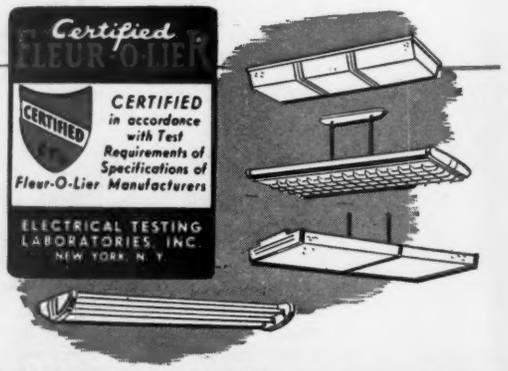

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1949 — Can Be a Good Year Too

You can expect good business to run on well through 1948.

But old-time competition is close upon us.

And 1949 will be a critical year for all of us – making lower taxation imperative NOW.

These are the main conclusions drawn from a nation-wide survey of industry's plans for new plants and equipment which McGraw-Hill has just completed. Here are the major findings:

1. Capital expenditures in 1948 may be a little lower — but at the most only 8% lower – than in 1947.
2. In 1949 capital expenditures may decline. 1949 plans are still fluid. However, those which have been projected now show a falling off. (Washington planners, please note: Current official attempts to discourage capital expansion may turn out to be superfluous – or downright dangerous.)
3. Industry's initial postwar rebuilding will be 85% complete at the end of 1948. When this first wave of deferred maintenance and expansion is finished, American industry will have more than half again the capacity it had in 1939. This does not mean the end of needed capital expenditures. Business will need to invest much more. (President Truman sets an investment goal immediately ahead of $50 billion.) But it does mean that tough competition is returning fast.

• IF YOU WANT *full details of the McGraw-Hill survey of Capital Expenditures, which is summarized in this editorial, write to the Economics Department, McGraw-Hill Publishing Company, 330 West 42nd Street, New York 18, N.Y.*

These are solid facts, based on plans which are firmly made by a broad cross-section of American industry and which the McGraw-Hill survey revealed.

The greatest contribution of this survey is the information it supplies on business plans for the purchase of new plants and equipment. What business planned to do about such expenditures was by far the biggest unknown element in the 1948 outlook. For, if business planned to slash its outlays for plants and equipment this year, that fact alone could bring a sharp downturn in business.

In making this survey, McGraw-Hill researchers all over the nation personally interviewed top executives of companies selected to make up a scientific cross-section of industry. Each executive was asked to give, *not his opinion* about general business trends, but *factual details* about his company's plans for 1948. By adding together the plans of the companies interviewed, McGraw-Hill has secured, for the first time, a reliable picture of what business plans to do in the months ahead.

Here are plans for 1948 and 1949, as revealed by the survey:

1. Industry still needs more than a year to finish its initial postwar maintenance and rehabilitation program.

Among manufacturing industries, top executives report that 64% of their program for the immediate postwar period is now complete. According to present plans, 85% will be installed by the end of this year even though some manufacturing industries still have a long way to go. For instance, oil companies will complete only three-quarters of their presently planned expansion program by the end of 1948.

2. Business may spend less on new plants and equipment this year than the record $16.1 billion spent last year. But the decline

probably will be negligible and certainly will not be great enough to bring on a business recession.

At the time McGraw-Hill interviewed top executives, some companies had not yet approved their 1948 capital budgets. Under the extreme assumption that those particular companies will make *no* capital expenditures in 1948, industry's 1948 bill for new plants and equipment will run to $14.9 billion, or 8% below last year's record figure. Under the more realistic assumption that those companies will cut their capital investment only as much as the companies which had already drawn up their plans for 1948, industry's 1948 capital budget will run to almost $15.8 billion, a decline of only $300 million from 1947.

Thus the over-all conclusion of the McGraw-Hill survey is that capital expenditures by business will be only slightly lower this year than last.

3. Business executives will not slash their 1948 capital budgets unless they are convinced that a real slump is in the offing—and they are not convinced now.

Almost two-thirds of all manufacturing companies say they would not cut capital budgets sharply even if business activity declined 20%. What is more, even a 15-20% boost in wage rates would have little effect on projected capital budgets. If wages go up, 57% of manufacturing companies would not change their capital budgets, 26% would increase them, and 17% would cut them.

4. Most executives look for an increase in their company's sales this year.

More than half of all manufacturing companies are planning on a sales increase over last year of 10% or more. A third of them say sales will be about the same as in 1947. And fewer than 10% look for lower sales.

5. Manufacturing companies will finance much of their purchases of new plants and equipment in 1948 from funds set aside out of past or current earnings.

Utilities and railroads, on the other hand, must go to the securities markets or commercial banks to finance most capital expenditures.

Although manufacturing companies say they can finance this year's capital expenditures in large part from current profits and past savings, all evidence indicates that, to do so, they will use up most of the funds they earmarked during the war for this purpose. So in 1949, industry must go to the capital markets or to the commercial banks if it is to continue to spend for capital purposes. If the securities markets continue to lie in the doldrums, *as they will under present tax laws,* only companies with triple A credit ratings will be able to raise funds that way.

6. Purchases of new plants and equipment may fall off in 1949.

The McGraw-Hill survey collected all available evidence on plans for 1949 capital budgets. Fewer than 40% of all manufacturing companies now have definite plans for 1949. Of those that have plans, 45% intend to spend less than in 1948, 30% plan to spend the same amount, and a quarter expect to spend more. These preliminary decisions would seem to indicate that capital investment may fall off in 1949.

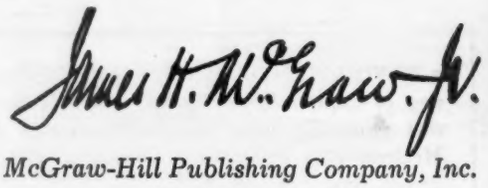
7. Industry's production capacity in 1949 will be far above prewar.

Manufacturing capacity will be more than 50% greater than in 1939 once the present wave of postwar building is complete. Almost a third of all manufacturing companies report that their capacity will be double or more than double the prewar figure. Thus, 1949 may see a huge increase in production of many things that now are hard to buy.

The last two points in this summary mean that 1949 will be a critical year. We must forestall a sudden drying up of capital expenditures in that year. We must be able also to absorb a great outpouring of production both of capital and consumer goods.

What will happen to business in 1949, therefore, will depend on how successful we are this year in dealing with such momentous problems as taxation, foreign aid and prices. But 1949 *can* be a good year too.

The next editorial in this series will discuss the pivotal problem of taxes.



President, McGraw-Hill Publishing Company, Inc.

THIS IS THE 65TH OF A SERIES

FEBRUARY . . . . at a Glance

No Industrial Slump

All indications and predictions, including our own of last month, were in the direction of considerable let-up in industrial construction for '48. Comes a very thorough survey based not upon expert opinion but taken from actual hard boiled budgets. It says that industrial capital expenditures will be lower in '48 but only slightly, in the order of 8 percent. The survey made by McGraw-Hill research on a nationwide cross section of firm budget figures for plant and equipment shows that postwar expansion still has a good year to run and is expected to reach 85 percent completion at the end of 1948. Since electrical men are involved in almost any phase of capital expenditures in plant or equipment, the prospects are uncommonly good for the year. But researchers warn of possible trouble in 1949.

The Deluge

Governor Dewey's recent remarks about the shortcomings of the construction industry may be suspected of some political tinge. The chances are, however, that it's only the beginning. The persistent housing shortage is going to be tossed around the political arena with little if any regard for facts. The not very vocal and poorly organized construction industry is unquestionably the safest scapegoat politically.

So between now and election we can expect denunciation and harsh words in fulsome abundance. If such lambasting would roll back construction costs, relieve skilled labor shortage, expedite efficient flow of scarce materials and so on, there would be many of us on the same platform.

Unfortunately, housing shortage is a chronic, deep rooted problem reaching back through war and depression. And today's housing costs are just as much a part of the national economic scene as the price of meat or shoes. We enjoy no exemptions from inflation.

During the next few months it will be difficult to separate political buncombe from sincere criticism but it must be done. The construction industry stands before the bar of public opinion in this housing crisis. Public opinion has a way of discounting political attacks but never long tolerates failure to meet challenges raised in honest and constructive criticism.

Network Feedback

Primary and secondary interconnections on industrial distribution systems provide a source of danger too often ignored or forgotten. Transformers work both ways. Opening the primary breaker or disconnects does not kill the transformer primary or associated apparatus while the secondary remains connected to a live network. The tyro just out of electrical school wouldn't have trouble. It's the experienced man who has grown to rely on upstream disconnecting for safety who is caught. While network installations usually include some type of interlock to insure disconnect at both sides of the transformer, electrical men working on such systems frequently find it necessary to bypass such interlocking momentarily in the course of repairs or tests. Under such conditions, the greatest care is essential. Best practice is to assume all high voltage terminals are alive until all disconnects are clearly open.

Relay Switching

Announcement of several relay switch systems for residential and commercial wiring is imminent. Tiny relays at the fixture outlet open and close the circuit. Switch legs are low voltage and carry only the small current needed to energize the relay coil. A number of installations are already in use around southern California. A new approach to switching methods is certainly welcome. Present practice, particularly in small residences, is no credit to the industry. Switch points are held to the very minimum. Multiple switching by 3 way and 4 way switches has almost disappeared except for such obvious essentials as stairways. Yet convenient control is the very essence of good wiring system design. Among many probable advantages in relay switching, the ease and simplicity of multiple control may open up a whole new approach to residential wiring layout.

Specialized Services

Buildings which house the operating headquarters of telephone or other wire services involve raceways and cable ways of considerable complexity. Usually designed for the specific needs of the building occupant, the systems nevertheless are a source of useful methods and ideas for similar wiring problems. The Pacific Telephone and Telegraph building job in Los Angeles, described by Southwest Editor Henry Young in this issue is a good example. Many features such as the duct wall are of interest to electrical men everywhere.

Show Wiring

Most of us have attended expositions and trade shows with hardly a thought as to the complex electrical hookup behind the scenes. Besides the problem of providing a great variety of wiring requirements to dozens of "customers" in one area, the factor of time is vital. The J. F. Fisher Company in Chicago are experts who have made a specialty in this field. It takes organization, good timing and unlimited diplomacy. You'll find the story on their operations on page 80 of this issue.

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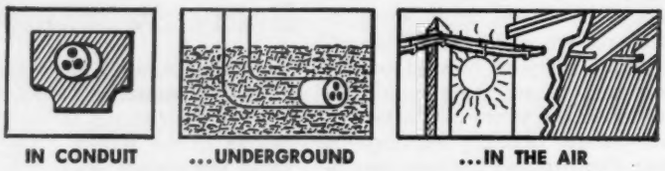

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JOB RESPONSIBILITY

IT IS COMMON PRACTICE to separate labor and materials for accounting. Items are charged to their respective categories in the job envelope. In estimating a similar procedure is followed. Here the division is even more distinct, since the units are different. Materials are tabulated by quantity and cost, labor by man hours.

SUCH A DIVISION, however, is purely artificial. The labor is closely dependent upon the materials used. The quality, the variations in engineering features, the weight, the packaging, or the delivery schedules on the selected material involves more or less variation in the labor required for its use and application.

THERE ARE MANY WAYS, for instance, of connecting a cable to a stud; solder lugs, indented lugs, or solderless lugs of several types. Each involves a different labor operation. Obviously, the labor is directly affected by the particular type of lug selected for the job. Similar variations in labor hour requirements apply to everything used on the job. They occur in conduit, panelboards, transformers or lighting fixtures.

ELECTRICAL CONTRACTORS and their supervisory personnel are acutely conscious of these variations. To know them is essential to survival in a highly competitive business. The wise contractor exploits his materials buying and handling function with constant vigilance for its effect on labor. The scheduling of deliveries also involves critical appraisal of the labor operation. Minor holdups on relatively inexpensive material items can involve disastrous risks in labor costs.

THE "LABOR ONLY" type of contract, divorcing the control of materials procurement from the contractors operation, substantially reduces his control over labor. The predictable labor risks, learned through long experience with conventional contracting procedure involving close control of materials, no longer hold. Job responsibility assumed by the contractor embraces so many costs beyond his control that it is difficult to see how such projects can be negotiated within the most liberal interpretation of prudent management.

IN PLAIN LANGUAGE, the "labor only" contract is an outright gamble. The essentials of job responsibility, the very management efficiencies which contribute to lower overall costs, the principles of a good bargain under which both parties benefit are scrapped for a devious and irresponsible device under which no one gains—and the contractor almost certainly loses.

SO LONG AS CONTRACTORS are willing to accept job responsibility on the basis of less than full control of materials, there will be those who will exploit him. There is no law, however, requiring a contractor to accept any offered contract terms. It is up to him to refuse. There is no way for the contractor to avoid full job responsibility. And job responsibility without control of materials can never be a prudent business risk.

Wm. F. Stuart

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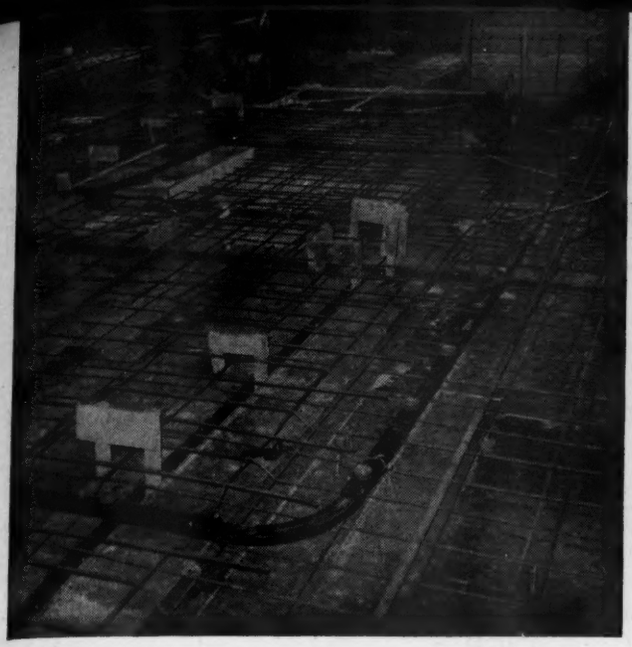


Wall elbows and three floor elbows in the duct system. A cabinet will be mounted above the wall elbows.

O. L. Grove, electrical superintendent for the R. R. Jones Electric Company checks over the underfloor duct system.

Specialized Services for Specialized Operation

Unusual wiring problems are encountered in fitting buildings for special services. The Pacific T. & T. building in Los Angeles illustrates some of them.

By Henry Young

VIEWED from the standpoint of its electrical installation, the Grand Avenue Telephone Building of the Pacific Telephone & Telegraph Co., Los Angeles, presents some specialized procedures on the part of the electrical contractor involved. The building is in effect an extension of the Mutual Exchange Building of the company, adjoining it on the rear. The new, 10-story steel and concrete structure is, however, a specialized purpose building in that it will contain no local exchange facilities but will be devoted exclusively to handling long distance connections, trans-continental and others.

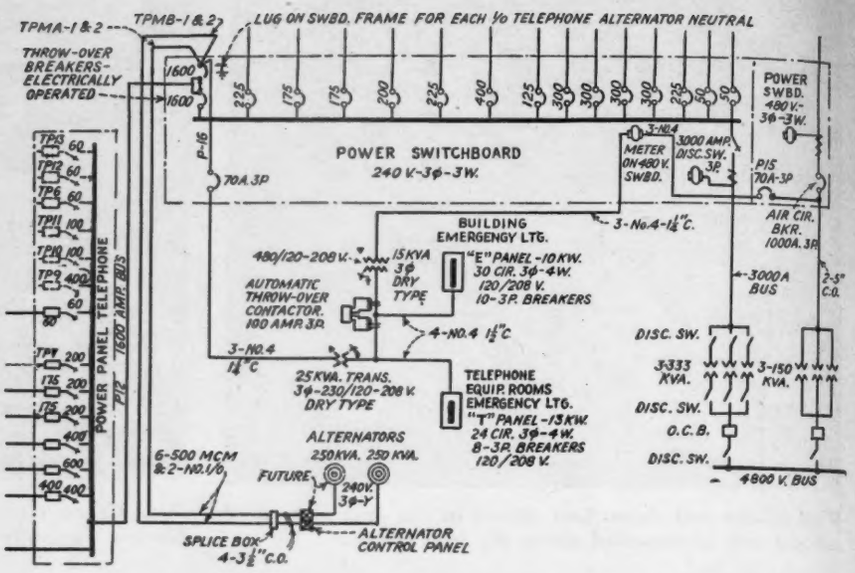
In its broad aspects, the work of the electrical contractor here is interesting from two angles. In addition to the power and light requirements, he undertakes to do such things as: provide the necessary ducts throughout the building to carry the telephone cables clear to the points where they fan out to enter the telephone switching racks, at which points the telephone company takes over; electrically connect a refrigeration plant of 125-tons capacity for the air conditioning of the building as a whole, but more particularly to remove the heat developed in connection with the operation of the telephone equipment; provide a standby gasoline engine driven power plant capable of supplying energy for the telephone requirements as well as for an independent emergency lighting service in case of the interruption of the regular source. Some of this work, concrete, masonry, special equipment installation, etc., is on sub-contracts, but he is nevertheless responsible and must supervise it.

The second interesting overall feature is that the electrical contractor is simultaneously installing two complete wiring systems in one half of the building, one to probably be completely removed at a later date. This is for the reason that, initially, five of the floors are to be used for company offices, the office lighting circuits being located in a false ceiling. When the need for additional telephone switching facilities makes it necessary, the offices may be removed entirely from each floor, partitions dismantled and the furred ceiling removed. Removal of the offices will leave each floor as originally designed for telephone service, with all floor ducts, junction boxes and floor outlets already in place in the concrete slab.

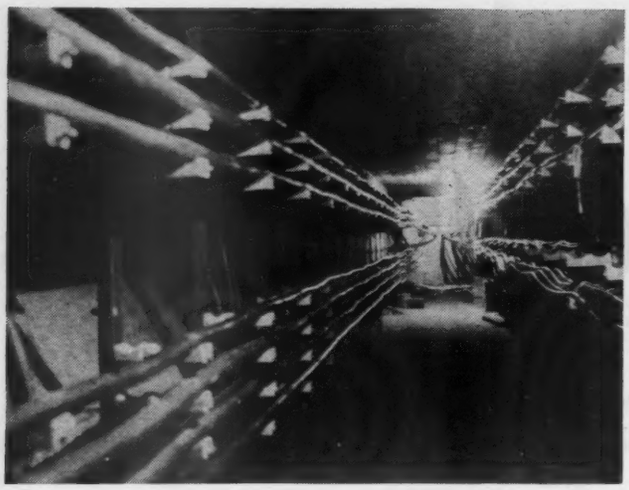
Transformers

The transformer vault for normal power service is located two stories below the street on one side, the building being on a side hill. This vault is 20 ft. by 45 ft. and is reached through doors

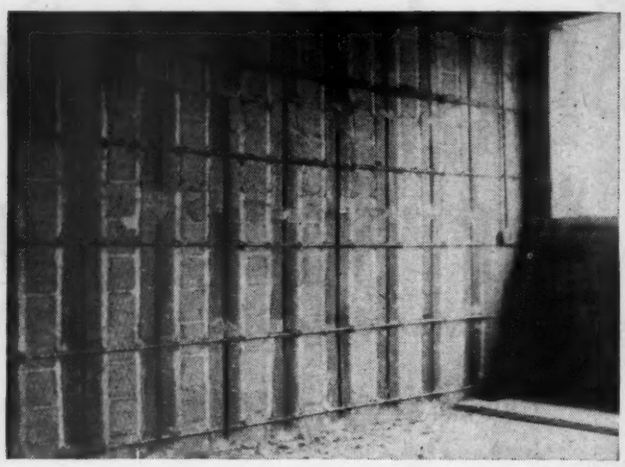
Ducts in wall are placed over holes through concrete floor slab.



One line diagram of main service, substation and switchboard,



Cable tunnel, riser leg, lead covered cables are racked on insulators.



Section of duct wall on one floor. Concrete blocks laid up between vertical ducts and the whole covered with wire mesh, ready for concrete plaster coat.

from a vertical areaway or well and sidewalk hatch.

For normal power, there is a bank of three 150 kva., 240 volt, three phase transformers. A special bank of three transformers with 150 kva., 440 volt secondaries for operation of the air conditioning system is located in the same vault. It furnishes power for operation of the motor of the 400 hp. compressor unit.

Another transformer bank, also located in the same vault, consists of three 333 kva. units for the lighting system.

All switching equipment for the power service from the main transformer vault is located on a switchboard in one corner of the basement, outside of the vault, half this board occupying the transformer vault wall, and the other half, at right angles, being against the building wall.

Feeder Tunnel and Risers

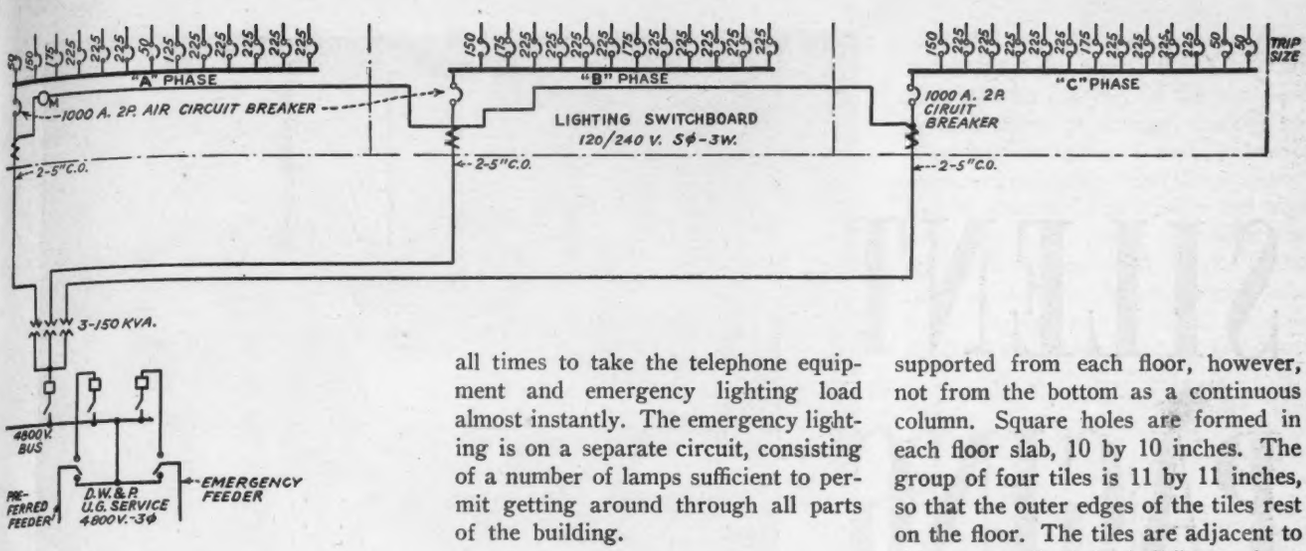
A tunnel below the basement floor is 5½ ft. by 5½ ft. in cross-section and 128 ft. in total length. It carries the secondary feeders for the power and light circuits from the switchboard to the risers serving the building. This tunnel has a right angle turn in it, one leg, under the switchboard, being 56 ft. long, and the other leg, under the risers, being 72 ft. long. The feeders consist of lead-covered cables on cable racks in the tunnel. The cables enter the tunnel from the rear of the switchboard, turn the corner and pass into two riser shafts reaching from bottom to top of the building.

The two sets of risers, which run from the basement to the top story, drop off circuits from floor to floor. One set, of 2½ to 4 in. conduit, starts out with 21 conduits at the basement level. The other set, of 2 in. to 4 in. conduit, starts with 18. The panel feeds to each floor are controlled individually through separate feeds from the basement switchboard.

Lighting

Referring to what might be termed the transient lighting system, for the office floors, this installation consists of recessed, fluorescent lights in 8-ft. sections, four lamps to the section. There are in excess of 1300 such sections required for lighting the office floors. As stated, all these will eventually come out, leaving only the permanent and emergency lighting systems for the telephone equipment floors as installed at the present time and held under wraps, so to speak, ready to be put into service when the time arrives.

The permanent lighting system, ex-



note emergency alternators at left.

cept for some incidental locations, is used for the lighting of the telephone equipment banks, which will eventually fill all floors solidly. The equipment banks reach nearly to the ceiling, with aisles between. The technicians and trouble shooters work in these aisles only when the occasion demands, and on ladders suspended from overhead ladder racks. Illumination, necessary only when they are working in an aisle, is obtained from a row of incandescent lamps at the ceiling with downward reflectors covering the aisle. When no one is working in an aisle, the lights are turned off.

No lighting system is proof against failure of the power source. To guard against such an emergency affecting the lighting of the building, and also to provide an emergency source of power for operation of the telephone equipment, the electrical contractor was called upon to install a gas engine driven, three-phase, four-wire alternator unit inside the building, ready at all times to take the telephone equipment and emergency lighting load almost instantly. The emergency lighting is on a separate circuit, consisting of a number of lamps sufficient to permit getting around through all parts of the building.

Duct System

The electrical contractor, among other things, undertakes to provide an access system for all telephone cables, from the outside of the building to where they enter the telephone equipment proper. As a consequence, he has been called upon to install a duct system of unusual size and scope.

The lead-covered telephone cables enter the new building from the old building through an inclined tunnel, the old building being down hill from the new structure.

Reaching the basement level, the cables are to be carried up to the various floors through a "duct wall", commonly used in telephone service buildings. This false wall, occupying one full side of the building, is approximately 140 ft. in width and 200 ft. in height. It is built of hollow tile and masonry, supported by the structural members of the building.

The hollow tiles which will carry the cables are set vertically in groups of four, so that a continuous opening through the tile is secured from bottom to top of the building. The tiles are supported from each floor, however, not from the bottom as a continuous column. Square holes are formed in each floor slab, 10 by 10 inches. The group of four tiles is 11 by 11 inches, so that the outer edges of the tiles rest on the floor. The tiles are adjacent to the outer wall of the building and are tied against the wall, at every fourth row by tie wires from eyes molded in the concrete, the wires extending around the whole group. To maintain exact alignment of the tiles, dowel pins are used at each of the four corners of each tile.

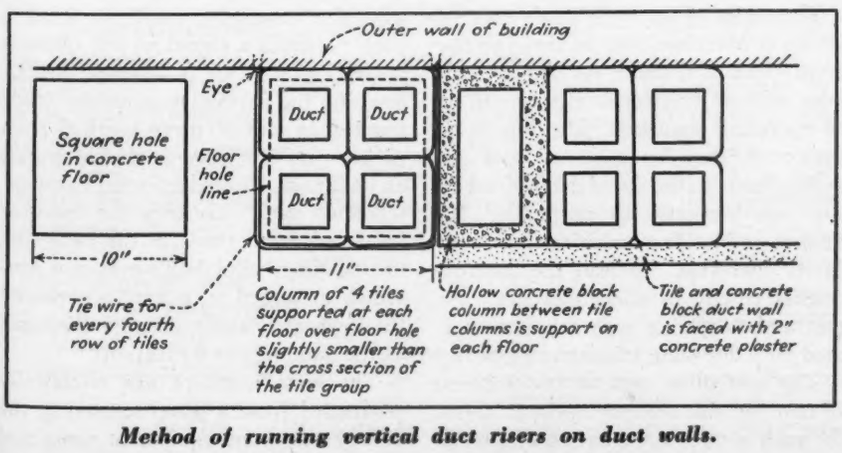
After the duct tiles are set and fastened on each floor, hollow concrete blocks, laid in mortar, are set between adjacent groups of duct tiles, the whole presenting when done a solid false wall, which is finally finished with a two inch facing of concrete plaster.

In this duct wall and in the runs to the other building the electrical contractor will place 50,000 feet or 20,000 pieces of tile.

The telephone cables which will pass up through the duct wall will be dropped off at the various floors and fanned out to enter all of the various equipment racks which they are designed to enter. Distribution of these cables at each floor calls for an elaborate duct system embedded in the concrete floor slab. The electrical contractor installed these ducts and of course before the slabs were poured. Standard Nepco duct was used, $1\frac{3}{8}$ in. by $2\frac{7}{8}$ in. in cross-section.

The ducts in the floor system are laid approximately 9 ft. 8 in. apart one way and 20 ft. apart the other, forming a net work, with a junction box at every crossing. To complete the system, floor outlet boxes are provided every two feet along each duct. Approximately 800 such outlet boxes are provided on each floor, and in the future, should any occasion arise for more, openings can be drilled through the floor and into the ducts.

The whole building is air conditioned, including the offices and those


Outer wall of building
Eye
Square hole in concrete floor
Floor hole line
Duct
Duct
Duct
Duct
10"
11"
Tie wire for every fourth row of tiles
Column of 4 tiles supported at each floor over floor hole slightly smaller than the cross section of the tile group
Hollow concrete block column between tile columns is support on each floor
Tile and concrete block duct wall is faced with 2" concrete plaster

Method of running vertical duct risers on duct walls.

[Continued on page 174]

SILENT PAGING

New department store paging system uses visual call annunciators and optional audible signal.

By A. A. Schuhler

Visual paging is provided by ceiling suspended lamp annunciators with capacity of 120 different calls.

THE John Wanamaker department store in New York City has recently installed a semi-electronic, silent visual paging system which also incorporates an optional selective audible feature. The system is the first of its kind anywhere in the world.

It is located in its furniture division on the sixth and seventh floors, and is used to locate and summon 40 salesmen to a supervisory desk on each of these floors to answer telephone calls. These calls may originate from customers, the store's suppliers, warehouse, accounting department and many other sources.

In the short time that the system has been in use, it has resulted in increased efficiency inasmuch as the salesmen have been readily reached without noise and disturbance. It has also eliminated considerable confusion which existed previously.

The system is known as the Faraday auto-sequence visual paging system. Its capacity as applied in this particular installation using three digit code numbers is 56 different calls. This is based on the use of the figures 1 to 8 inclusive, since these are the only figures used in making up code numbers for calling purposes. The ultimate capacity using all figures from 1 to 9 and 0 would be 120 different calls. It is possible to increase the number of available calls considerably with other digit combinations, however, the three digit system is recommended so as to provide a continual check on the lamps in the annunciators.

The codes of six individuals may be set up at one time, that is, three on the sixth floor and three on the seventh floor without interference in timing or in operating sequence. The timing of each call may be adjusted and set within limits to the speed determined by the best response to the calls. No motors or flashing machines are used in its operation. Instead the controls consist chiefly of silent mercury contact and telephone type relays associated with dry plate selenium rectifiers.

The system in general is composed of two portable selector keyboards, one for each of two floors, one control panel for entire system, and ten double faced ceiling suspended type lamp annunciators of which five are located on each of two floors. A total of four 4 inch single stroke underdome bells are included for a selective audible signal. These are divided equally on the extreme ends of each floor. The bells are fastened to the ends of four annunciators, two on each floor.

The system is operated by a desk attendant, one on each of the two floors, who after receiving a call for a salesman, registers a signal on the system's annunciators. This is accomplished by pressing the particular salesman's code number in any of three vertical rows of keys on a special keyboard shown on next page, located adjacent to the attendant's desk. To keep the operator informed at all times of the calls that are flashing, pilot bull's-eyes are provided, arranged in a vertical row on the keyboard, and numbered the same as the annunciator indications.

The code numbers are electrically controlled from a panel located in the nearby telephone equipment room and

Codes for six individuals may be set up on selector keyboards at calling stations.

causes the calls to be flashed on all annunciators in the system. The numbers flash on and off at regular intervals until the salesmen notify the respective operators that they are ready to take the call. The numbers, invisible when not lighted, are two and one-eighth inches high, and when lighted can easily be read from a distance of 50 feet.

In the event of an emergency, or should a salesman delay in answering his signal, the operator may push another button at the top of the same vertical row of keys to operate the audible bell signal. This signal only operates momentarily while his code number is illuminated and is flashed on the annunciators.

When a salesman is located and takes his call, the attendant resets the keys corresponding to his code number. This action extinguishes the lamps and silences the audible signal associated with this person's call. However, the code numbers of the other salesmen continue to flash without any interruption, blank spaces or unused intervals.

Each of the glass panels for the lamp annunciators is marked horizontally with ten digits, namely 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. The first eight figures are used in making up the various code numbers, and the last two figures are used to identify the two different floors on which the telephone is to be answered. Frequently a salesman on the sixth floor may show a customer a piece of furniture on the seventh floor or vice versa, and under such circumstances the call may readily be transferred from one floor to the other.

The code numbers consist of three digits made up of numbers from 1 to 8, and are always arranged from the lowest to the highest number such as 123, 267, etc., but never the reverse. Admittedly, the figures 9 and 0 do not give a direct reading for the sixth and seventh floors. A change whereby another set of figures 6 and 7 were to replace the figures 9 and 0 was nevertheless considered originally and then decided against because of possible confusion due to duplicated figures. Under those conditions there would have been in use the figures 6 and 7 for the code numbers and another set marked 6 and 7 for the floor numbers. Both sets would have been located to the right of the center line of the annunciators and this was considered too close to prevent confusion.

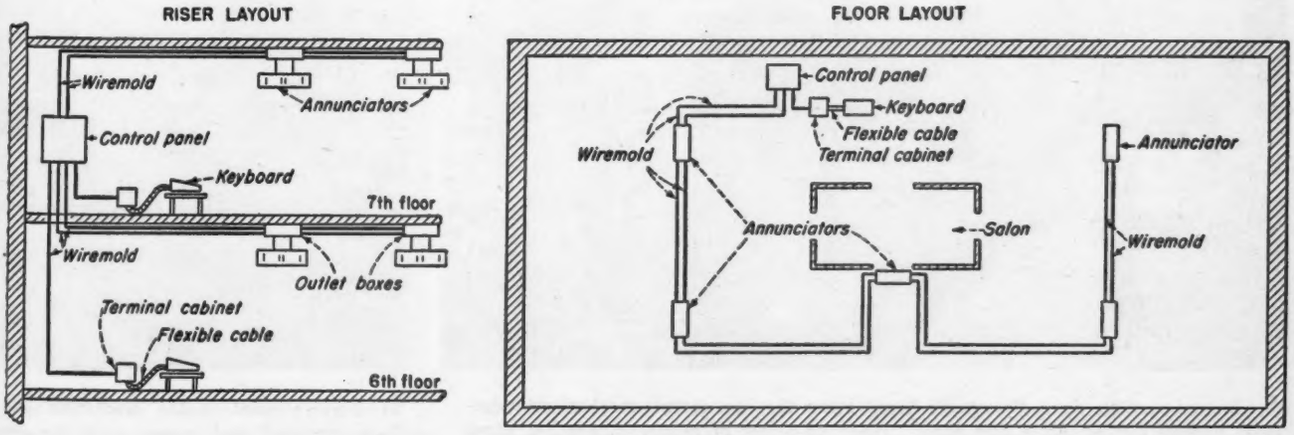
The installation was accomplished by Wanamaker's own electrical department. It is of the surface type and in general is laid out as shown in the accompanying floor layout.

The ducts in which the wire is run is Wiremold No. 1000 which normally is approved to carry up to ten No. 14 conductors. The bends or turns were made with standard Wiremold fittings. The outlet boxes are a part of the ceiling suspended lamp annunciators. The terminal cabinets are a part of the portable keyboards and are interconnected with flexible cables provided by the manufacturer of the equipment.

The wiring from the control panel to all of the multiple connected annunciators normally consists of twelve wires. Of these there is one common feeder wire, ten section or point wires and one common audible signal or bell wire. However, in looking forward to possible future refinements, and considering maintenance, a total of 14 No. 14 inch rubber insulated conductors were installed, thus providing two spare wires.

The Wiremold installation for the annunciators and the audible signals

(Continued on page 178)



Riser layout and typical floor layout of the visual paging system.

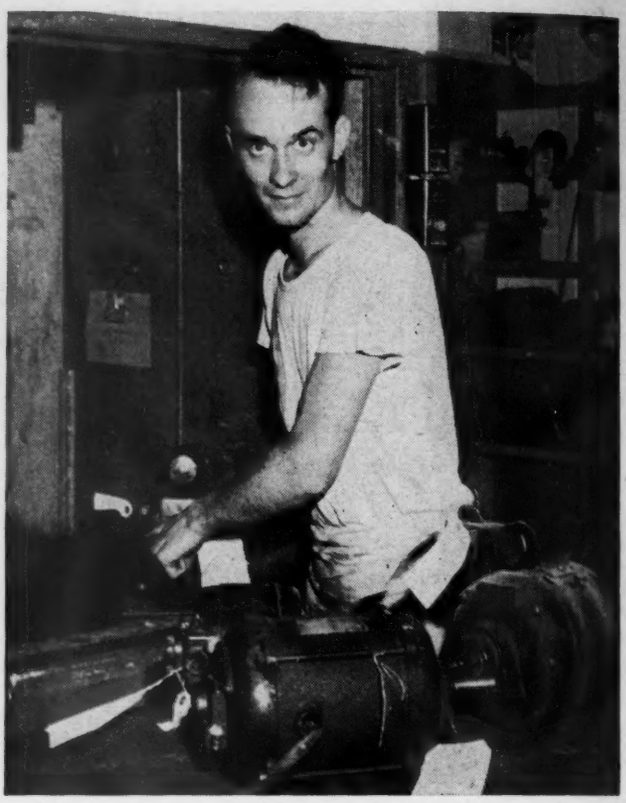
SECTIONALIZED SMALL

Special motors, standard units and minor repairs go separate ways in Koontz-Wagner Electric Company's well organized small motor department.

ONE keystone of profitable small motor shop operation is an efficient shop layout that permits application of production line techniques. This was the basis of the small motor department organization at the Koontz-Wagner Electric Company, South Bend, Indiana. Effective sectionalization of a 2,500 sq. ft. second floor area keeps miscellaneous and special work out of the regular repair channels, eliminates confusion, reduces non-productive "footwork" to a minimum, and increases shop output.

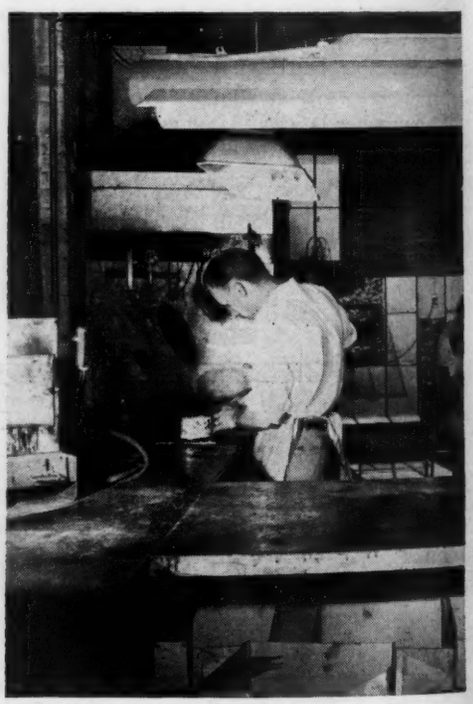
The shop is divided into three major sections: (1) A special motor and fan section where all but standard equipment is repaired; (2) a mechanical repairs section for testing, disassembly, parts and bearing replacement, minor repair and final assembly of standard units; (3) an electrical repairs section for armature and stator rewinding and commutator repairing.

Focal point of the layout is the small electric elevator which opens to either the special unit or standard motor sections. All motors enter and leave the shop at this point. Data on all jobs are entered on work order blanks, a



1. *Motors come up from first floor on electric elevator; can be unloaded from this or other side. Special units go to separate department for repairs.*

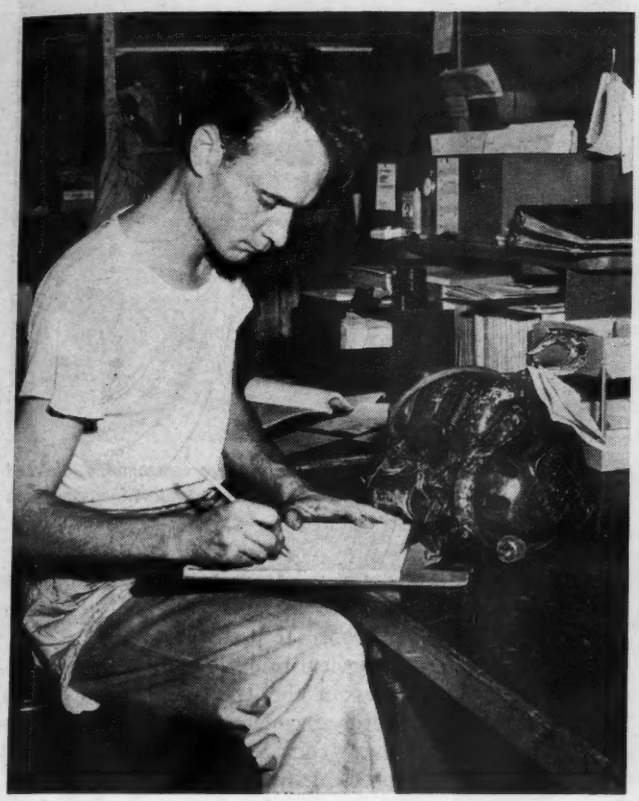
4. *Motors continue down disassembly bench where they are tested, checked, disassembled, cleaned and placed in tote boxes. Type and extent of repairs needed are noted on work order. Note test panels, meters and hand tool racks.*



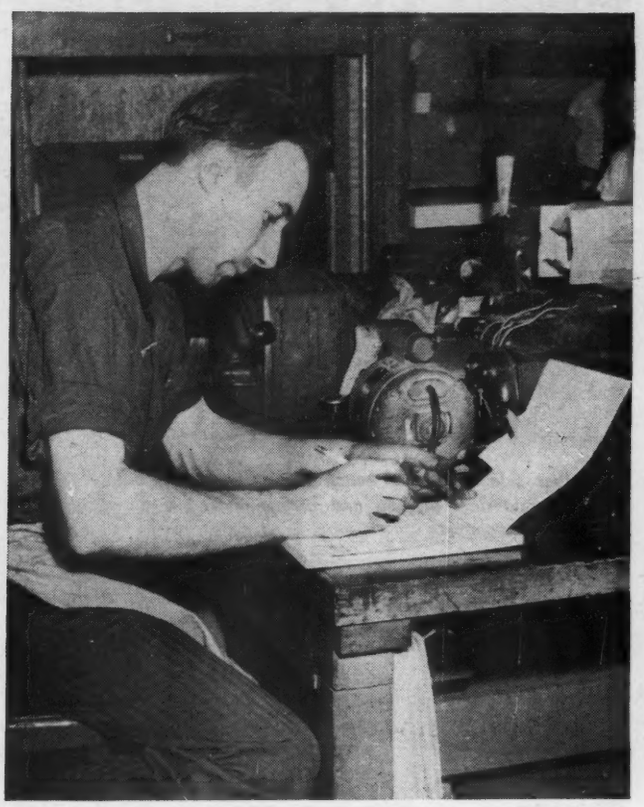
5. *Turning point in the production line. Units requiring replacement parts or mechanical repairs turn right to the final as-*

MOTOR SHOP

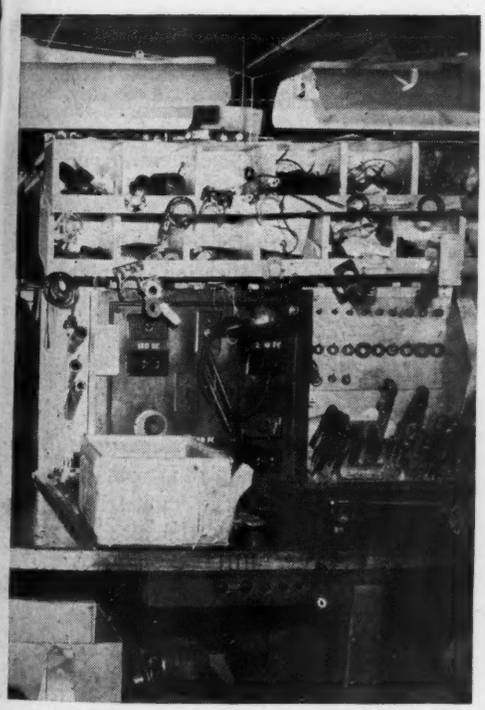
By August Eckel



2. *Before this hoist unit goes to the special motor department, complete nameplate data is entered on work order. Copy of data goes in master file for quick reference, work rack and job file.*

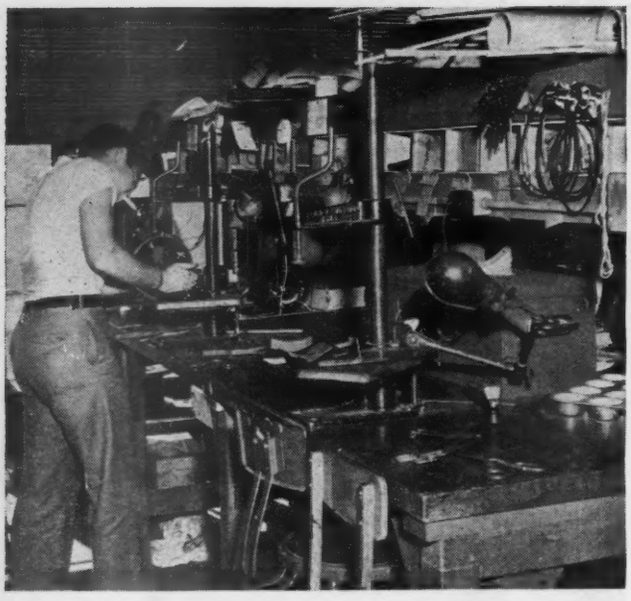


3. *Standard motors start their trek through the shop at the head of the disassembly bench.. Here data on a motor is being recorded on a "flat rate" work order. Note elevator in background.*



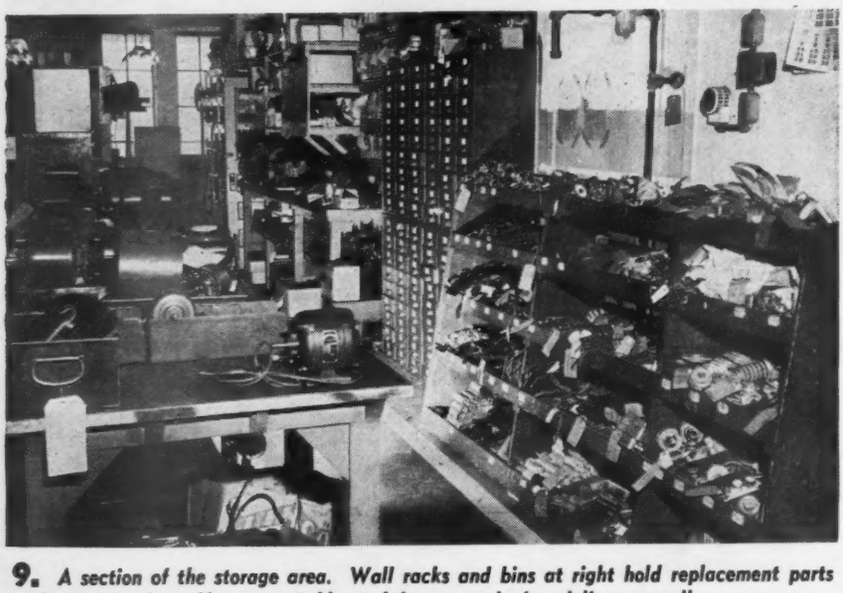
sembly bench; rewinds continue straight to winding department. Note parts bins above test panel.

6. *Coils are wound on one-half of a double bench.. Finished coils are passed under bins to other side where stators are wound. Armature winding and commutator undercutting is done in area to right of operator.*

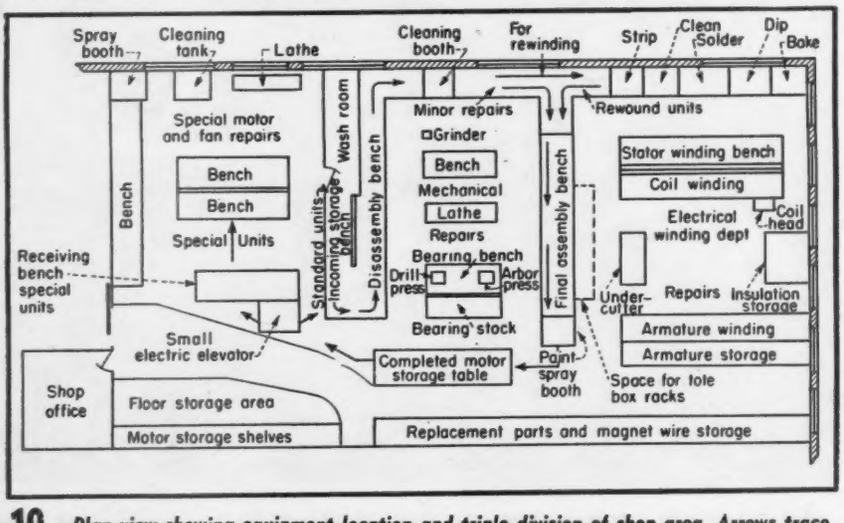


7. *Other side of double bench is for stator winding. Stripping, cleaning, soldering, dipping and baking units are on bench along wall behind mechanic.*

8. *Final assembly bench where all motors are reassembled, checked and tested. Every repaired unit gets new coat of paint in spray booth in foreground.*



9. *A section of the storage area. Wall racks and bins at right hold replacement parts and magnet wire. Motors on table at left are ready for delivery or call.*



10. *Plan view showing equipment location and triple division of shop area. Arrows trace routing of repair work from time it comes off elevator until ready for delivery. Note special motor repair department behind elevator.*

"flat rate" form being used for most standard motor repairs. Motors then go along the production line.

Concentration of the mechanical repairs in the U-shaped area between the disassembly and assembly benches saves considerable "lost" time and speeds delivery of minor repair jobs. Similar economies are effected by centralizing all electrical repairs and isolating miscellaneous and special work.

Additional time economies are assured by having ample stocks of replacement and repair parts in bins directly over work benches. Sample parts on the bins constitute a visual file for quick identification and comparison with parts needing replacement. Additional inventories of parts and stock along one wall of the shop are within a short distance of all work benches.

Although sectionalization involves some duplication of equipment, "waiting in line" to use a cleaning booth, lathe or spray booth is eliminated. Each section has the equipment it requires and there is no necessity to "borrow" from another department. The economies of this plan are obvious.

For a tour through the standard motor repair line, follow the attendant plan and sequence photos. Koontz-Wagner has succeeded in spotting a vast array of equipment in such a manner that plenty of storage space, aisle space, bench space and "elbow room" for the mechanics results. The over-all plan adds up to more efficient operation, better worker morale and better customer service.

Banking area is illuminated by flush-mounted diffuse fluorescent fixtures and totally indirect ceiling coves attractively outlined by continuous fluorescent troffers.

Skyscraper Distribution

Ten miles of fluorescent lamps, 1500 tons of refrigeration, 1200-feet-a-minute elevators, and scores of motorized services are installed in the most recent addition to New York City's Rockefeller Center.

By Hugh P. Scott

ONE of the largest and most modern office skyscrapers to be built during the past decade is the recently completed Esso Building; the fifteenth structure in New York City's Rockefeller Center development. The huge 33-story T-shaped building facing the northern side of the Plaza occupies a ground area of 37,500 square feet and contains a gross rentable area of over 8 acres. A central tower, 90 by 127 feet in plan, rises without setbacks to a height of 424 feet. Occupied mainly by the Standard Oil Company of New Jersey, the project represents a construction investment of over $7,000,000.

Containing such diverse facilities as a huge four-level restaurant, a bank, drafting and conference rooms, maintenance and shop areas, clerical space and an auditorium, the building is designed for a wide variety of electrical and mechanical services. Illumination is consistently high level in intensity, uniform in distribution and diffuse in character. Over ten miles of fluorescent lamps are installed. The structure is the tallest New York office building to be completely air conditioned; not merely air cooled. Refrigeration totals 1500 tons. Scores of normally manual operations have been mechanized through the installation of motors which are pushbutton controlled either from a central alarm room or from the various installation points.

In conformity with the established architectural treatment of the entire Center, the limestone exterior is designed with modern simplicity. Revolving entrances in a clear glass wall, 65 feet in width and recessed 18 feet from the northern building line, give access to a massive bronze-walled lobby extending through the entire building. In the lobby proper, white Roman travertine faces the banks of high-speed elevators and rises from a floor of Venetian terrazzo to the 18-foot ceiling.

Primary lobby lighting is totally indirect, emanating from parallel rows of unique cold cathode ceiling coves. (Fig. 1-a). All coves contain double runs of tubing with ends staggered to insure continuous uniformity of light on the white ceiling. Transformers for the 40 ceiling circuits are contained in

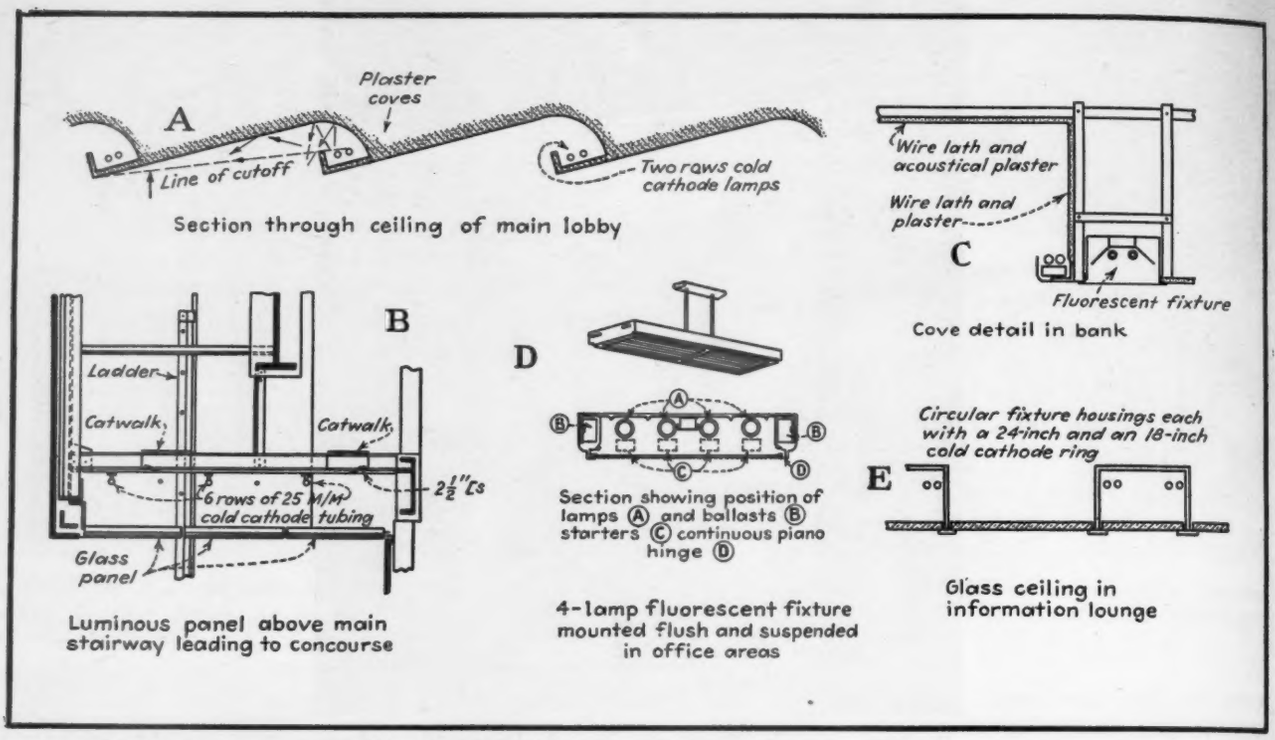
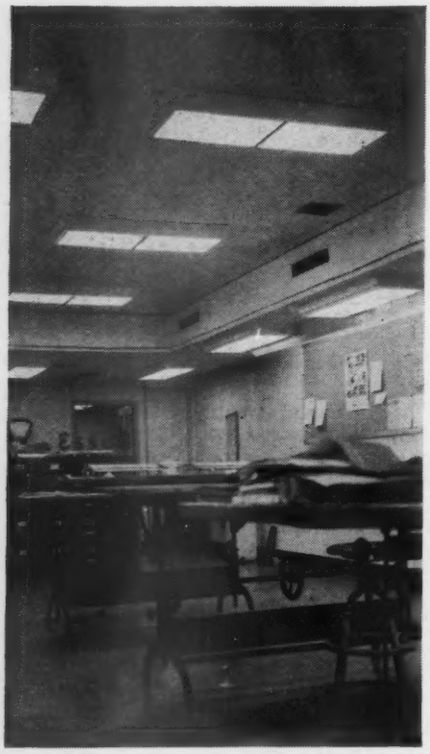


Fig. 1. Lighting treatments combine functionalism with decorative themes. The lobby is indirectly illuminated by series of overhead coves (A) while a section of this same area above a broad stairway is lighted by a luminous panel backlighted by parallel cold cathode tubes (B). The banking area features several large coves framed by continuous fluorescent troffers (C). Office space is lighted by slim 4-lamp unit (D) while the Information Lounge utilizes an all-glass ceiling, behind which special cold cathode housings (E) are mounted for decorative pattern.



Drafting room is lighted by 4-lamp fluorescent units with hinged Alba-lite glass panels. Intensities average 60 footcandles over drafting tables. Auxiliary fluorescent strip cove, mounted two feet in front and above bulletin board (at right) highlights this wall area.

cabinets, recessed into upper walls and covered by flush, wall-matching bronze panels. To provide for all-night lighting, six of the 40 circuits remain in continuous use. Provision for night lighting is also incorporated in the circuiting of downlights over entrances and the areas of sidewalk recessed inside the building line. Four circuits control these fixtures, three circuits wired for 3-phase 4-wire distribution with the fourth circuit, for night lighting purposes, single-phase 2 wire.

A second lobby-lighting treatment illuminates a broad stairway connecting the main floor with the subterranean Center-connecting concourse. In this area the ceiling is completely luminous with 25 mm. cold cathode tubes on 15-inch centers mounted 15 inches above an opal glass canopy. (Fig. 1-b).

Entrances from the exterior of the building as well as from the lobby lead to an information lounge, a modern restaurant with a seating capacity for 1200 people, and a spacious banking area.

In the information lounge, a service desk, exhibition niches and displays of plant life are primarily illuminated by several applications of cold cathode lighting. The major portion of the ceiling is luminous with runs of cold cathode tubing on 12-inch centers back-lighting opal glass panelling. The area immediately inside the exterior revolving door is lighted by ten 30-inch ceiling-recessed circular fixtures, each illuminated by two cold cathode circles, 18 and 24-inches in diameter. The Touring Aid Information desk, extending along one wall, receives added illumination from an overhead panel containing 4 rows of 25 mm. cold cathode.

Lighting in the bank area is accomplished with flush mounted 4-foot fluorescent fixtures and totally indirect coves. The flush fixtures are installed singly and in continuous runs combining from 2 to 7 units in each run depending upon available space and established lighting patterns. Coves are attractively outlined by continuous frames of direct double-row fluorescent assemblies. (Fig. 1-c).

Leaving the main floor, mention should be made of a 4-lamp fluorescent fixture which is standard throughout the office space in the building. The unit, designed by Pollak and Grieve in conjunction with the Edward F. Caldwell Company of New York City, is a trim, shallow fixture with hinged panel of Alba-lite glass. (Fig. 1-d).

Due to large window surfaces and the fact that normal business hours are during daylight, spacing of fixtures in

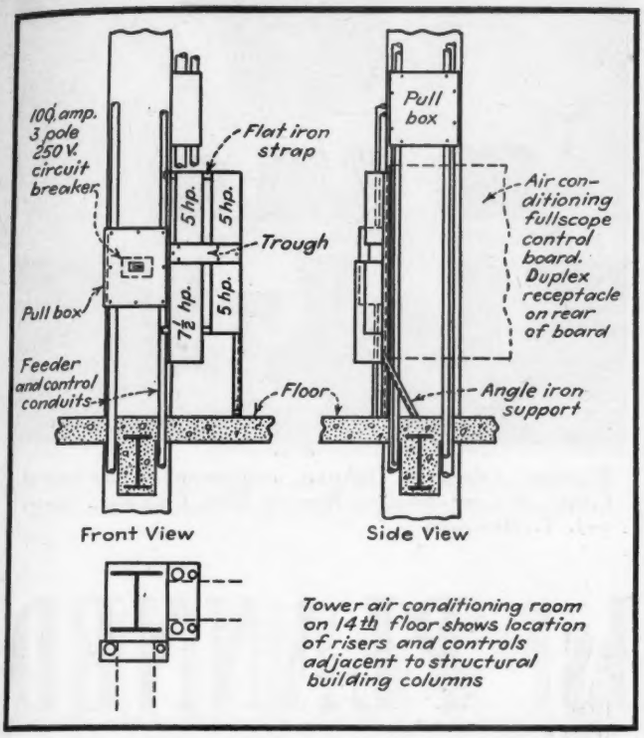

100 amp. 3 pole 250 V. circuit breaker
Flat iron strap
Pull box
Air conditioning fullscope control board. Duplex receptacle on rear of board
5 hp.
5 hp.
Trough
7½ hp.
5 hp.
Pull box
Feeder and control conduits
Floor
Angle iron support
Front View
Side View
Tower air conditioning room on 14th floor shows location of risers and controls adjacent to structural building columns

Fig. 2. Risers for upper floor air-conditioning rooms, power and lighting panels, are carried adjacent to structural steel columns. Controls for air conditioning equipment also are mounted on building steel. Individual air conditioning centers are sub-metered for data purposes.

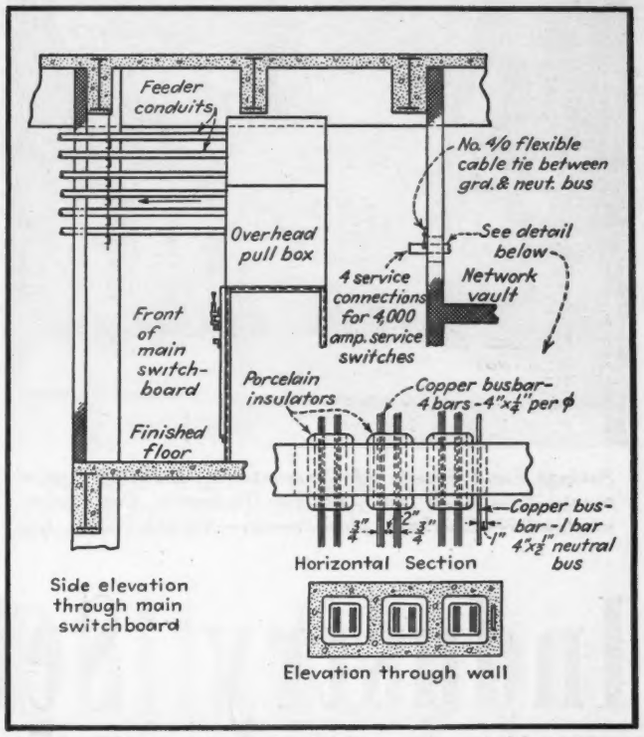

Feeder conduits
No. 4/0 flexible cable tie between grd. & neut. bus
Overhead pull box
See detail below
Network vault
4 service connections for 4,000 amp. service switches
Front of main switchboard
Porcelain insulators
Copper busbar-4 bars-4"x¼" per ϕ
Finished floor
Copper busbar-1 bar 4"x¼" neutral bus
Horizontal Section
Side elevation through main switchboard
Elevation through wall

Fig. 3. Utility service is carried into main switchboard area by porcelain insulators (see detail). Main switchboard has four 4000-ampere service switches for compressor, power and lighting sections of board. Feeders pass through overhead pullbox to 60 parallel conduits.

office areas is greater nearer windows than by interior walls. Spacing is also greater on upper floors since natural light is less obstructed by other buildings at these higher levels. Maximum spacing, in corner offices on the upper six floors, is 10 feet in either direction for the 4-lamp 40-watt units. This results in a consumption of 2 watts per square foot. Minimum spacing, in some of the smaller interior offices on lower floors, is 60 square feet per fixture with a resulting unit consumption of 3.3 watts.

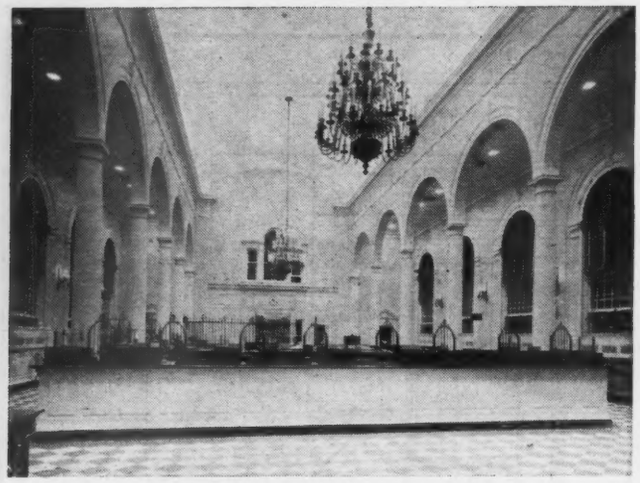
The average lighting intensity throughout the building is better than 30 footcandles. Individual areas, such as the drafting room, have intensities above 60 footcandles and a few areas, such as utility areas and corridors, drop to 15 footcandles. The light is predominantly fluorescent with over ten miles installed throughout the structure. Of this total, approximately 20 percent is on the main floor in the lobby, restaurant, bank and information lounge.

Lighting circuits for each of the lower nine floors are 128 in number, controlled by two double panels. From the tenth floor upwards, circuits per floor are halved and are controlled by two single panels. Circuits for main-floor lighting total 266 and are connected to separate panels for lobby, restaurant and bank. Lighting for exits and stairways is separately circuited. All vertical riser shafts are provided with cable supports every four floors.

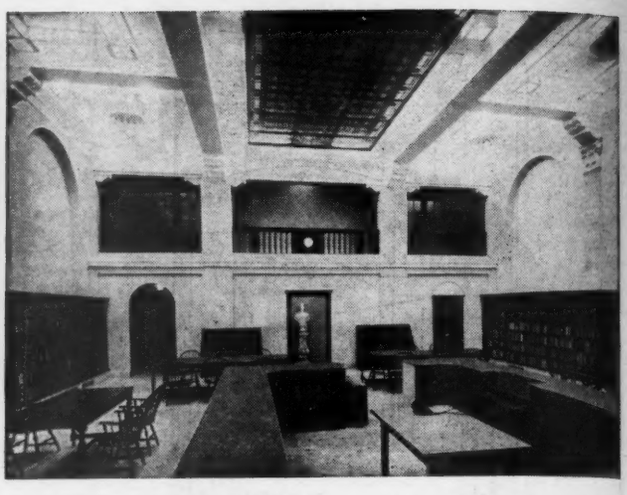
Not only is the Esso Building air cooled, but it is completely air conditioned with automatic motorized provisions for controlling temperature, humidity and air purity. Refrigeration totals 1500 tons, with two compressors of 700 and 800 hp. located in the sub basement and connected by busbars directly to the main power switchboard. Chilled water circulates to local air conditioning units, two of which are located on the third, sixth and ninth floors with single units serving each three floors above this level. In these local air conditioning rooms filtered air is cooled, humidified and circulated to all areas through ceiling and wall-mounted louvred ducts. Distribution risers to these local a-c rooms are installed adjacent to structural building columns as shown diagrammatically in Fig. 2. As an aid in bookkeeping and for the compilation of data concerning air conditioning requirements for various areas and conditions, current consumption for each air conditioning room is recorded by a bank of sub-

(Continued on page 176)

Construction picture shows framework for opal glass ceiling panels over lobby stairway leading to concourse. Above framework can be seen socket connections for cold cathode tubing, transformer and maintenance catwalk. Luminous ceiling provides 30 footcandles of lighting on stairway.

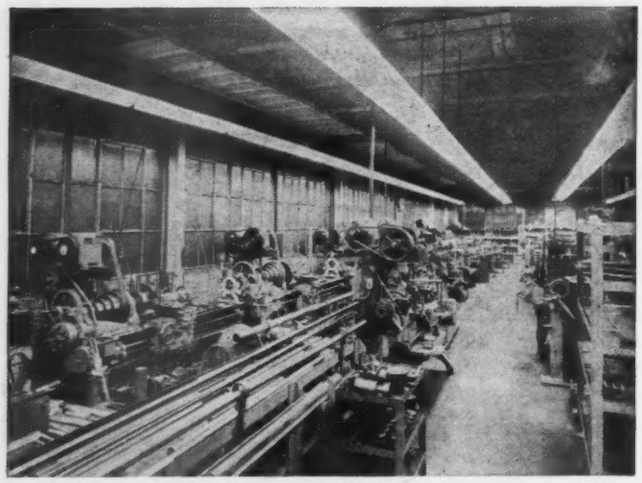


Savings Fund Society of Germantown. Lighting equipment—Pittsburgh and Klemm Reflector Cos.; elec. wholesaler—Graybar; elec. contr.—Schuck Elec. Co.



Widener Library. Lighting equipment — Litecontrol Corp.; elec. wholesaler—Rumsey Elec. Co.; elec. contr. —J. T. Hammer.

Industry Sells PLANNED



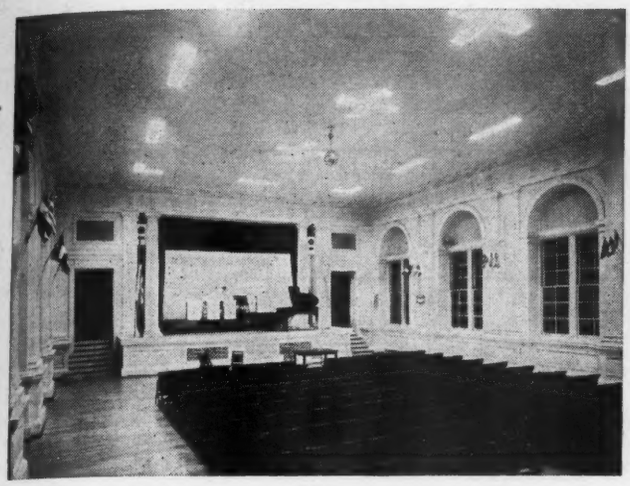
THE principle of the *Planned Lighting* program is not new to Philadelphia. Neither is the theme of *Interdependence.* Both have been in operation on a successful basis for many months, as is well demonstrated by pictures of a few of the recent outstanding lighting installations shown on these two pages.

Spearheaded by the Equipment Manufacturers' group of the lively Electrical Association of Philadelphia, all segments of the lighting industry in 1945 united in a cooperative and far-sighted *Planned Lighting* promotion, which is now resulting in increased lighting sales for all, and unique and unusual lighting installations for well satisfied customers.

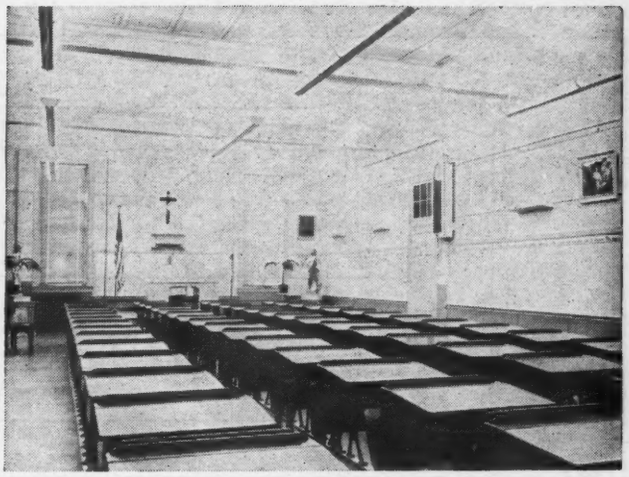
Haskell-Dawes Machine Co. Lighting equipment—Wheeler Reflector Co.; elec. wholesaler—Graybar Elec. Co., Inc., elec. contr.—Schuck Electric Co.

Liggett's Drug Store. Lighting equipment—Lynn Tube Co. and Acme Transformer Co.; elec. contr.—The Barney Roth Company.

Royal Oaks. Electrical contractor Ray Weaver sold and installed this fluorescent cove lighting system consisting of single row of 40 watt lamps on wiring channel.



Young Men's Christian Association. Lighting equipment —Klemm Reflector Co.; elec. contr.—Utilities Engineering Company.



Villa Maria Academy. Lighting equipment—Edw. F. Guth Co. and Cutler Light Mfg. Co.; elec. wholesaler— Graybar Elec. Co., Inc.; elec. contr.—J. T. Hammer.

LIGHTING in Philadelphia

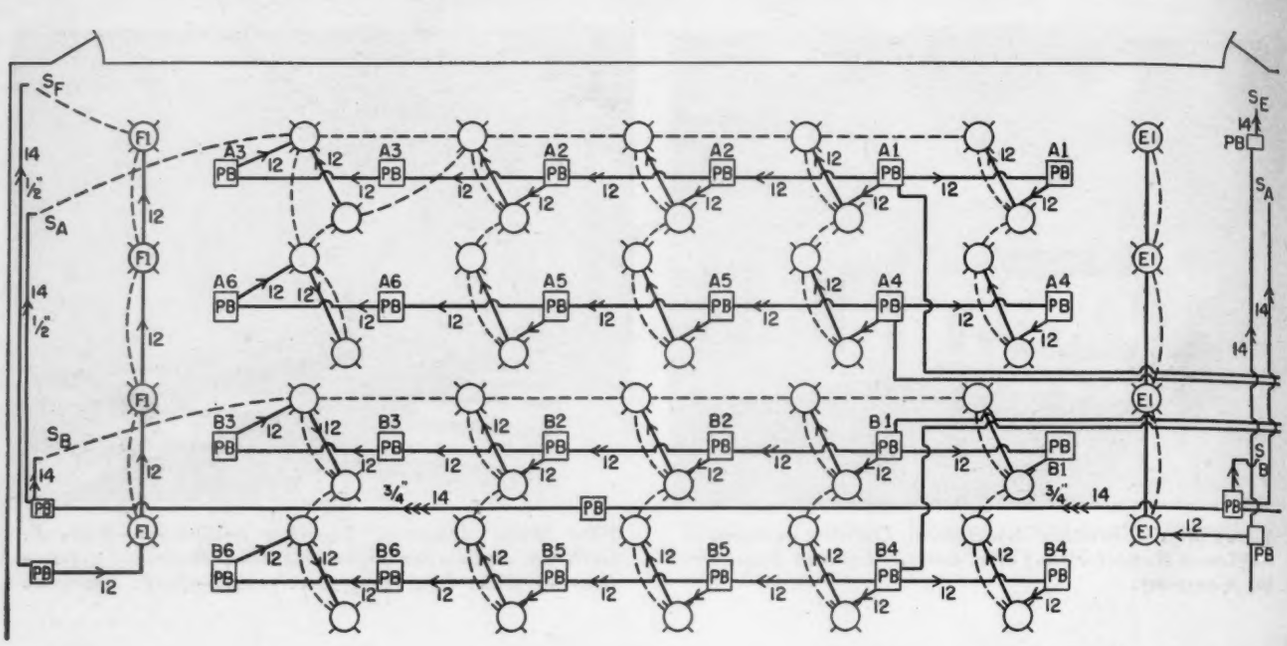
Cooperating in the Philadelphia *Planned Lighting* activity are the Lighting Applications Section of the Philadelphia Electric Company (electric utility), lighting equipment manufacturers and their representatives, lamp manufacturers, electrical wholesalers and their lighting specialists, and electrical contracting industry.

Practically all segments of the industry depend on the Lighting Applications Section of the Philadelphia Electric Company for lighting plans and engineered lighting layouts. Installations shown on these two pages are typical of the jobs so planned and sold. This service is available to all electrical contractors, considered a key figure in this program.

Alan Wood Steel Co. Lighting equipment—Westinghouse; elec. wholesaler—Westinghouse Elec. Supply Corp.; contr.—Electrical Dept., Alan Wood Steel Co.

Food Fair Super Market. Lighting equipment—Metalcraft Products Co.; elec. wholesaler—West Phila. Elec. Supply Co.; elec. contr.—Jacob Busch.

Robison-Grayson Co. Lighting equipment—Kurt Versen and Klemm Reflector Co.; elec. wholesaler—Graybar Electric Co., Inc.; elec. contr.—Morris Newmark.



MEAT PLANT WIRING

WE have recently completed a very interesting and practical wiring installation for an addition to the Coronet Packing Co., Los Angeles, Calif. The entire construction program was under the direct supervision of A. Mueller, the owner.

From an electrical standpoint, we endeavored to correct the faults of buildings that are used for the same purpose; to protect wire, switches, contactors, motor controls etc., from deterioration and breakdown, because of subnormal temperature.

The structure, 96 ft. by 98 ft., consists of two stories: a main floor at ground level to be used for a meat holding sales room and loading dock; a basement floor below the ground level to accommodate the hard cooler, pickling and boning rooms. The hard cooler is to be refrigerated to zero. The pickling boning and entire main floor is to be kept at 35 deg.

After the electrical engineering and layout of the building was completed, we installed a lighting sub-feeder of 300-ampere capacity and a 480 volt power sub-feeder of 150 amperes capacity. These runs were 200 feet each from the existing services and were laid over and on the existing buildings and then terminated in a specially built penthouse erected on the roof of the new building for the panel board.

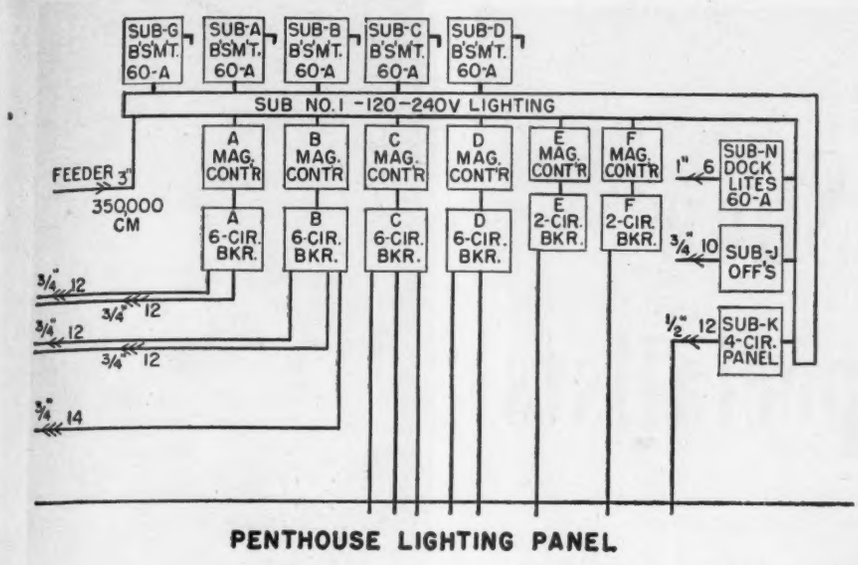
Meat holding and sales room, with its 12,500 wattage all turned on.

On this penthouse panel board we established all of the externally operated switches, magnetic motor controls, breakers, and magnetic contactors for the entire main floor. We also provided the sub-feed switches and breakers for the basement power and lighting and the office and dock lighting. All of the above named sub-feeders terminate in an enclosure or room of normal temperature.

On the basement panel board, we installed the breakers for the immediate lighting load and the switches and magnetic running protection for three motors to be used for the refrigeration blower system. These motors are located in the hard cooler and are energized individually by a home run, embedded in the slab, to our basement sub panel. The motors are operated remotely from a vaporproof start and stop station located beside each unit in the freezer.

The lighting in the basement was distributed over eight circuits. All fixtures and switches are vaporproof.

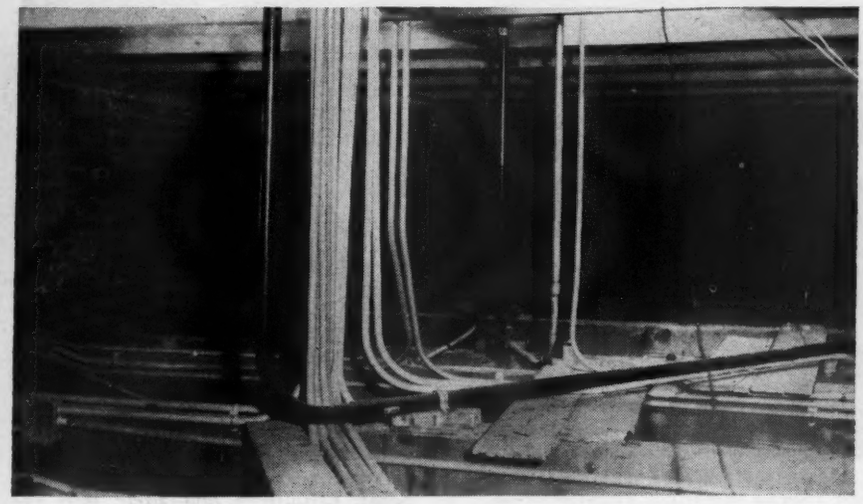
The main floor holding and sales



Wiring of the sales and holding room and showing, schematically, connections through penthouse control equipment.

Wiring for meat holding and sales involves careful protection of apparatus from cold and moisture.

By M. N. Shansby



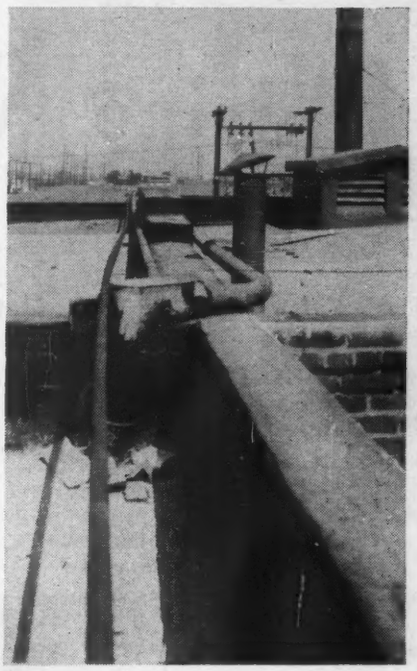
Conduit runs in the attic and beneath the penthouse.

room was the most interesting part of the installation. The owner was very emphatic in his request for an adequate lighting installation and an attractive meat sales room.

With this in mind, we wired this particular room with 28 circuits of No. 12 wire, having only two or three fixtures to each circuit. Several pull boxes were installed in each run, so as to make each circuit accessible. All of this wiring was done in the attic with steel tube. We installed eight staggered rows of 12 units each of the new 96-in. two-light, instant-start Slimline fluorescent units, employing soft white tubes. We then dropped down from our pull boxes in the attic, with conduit, directly into each fixture.

Our layout of the lighting specified the switching of each row or section from either end of the room. The orthodox method would have entailed a tremendous voltage drop and consequently larger pipe and wire. Having used three circuits to each row, we switched two rows or six circuits as one. This was accomplished by mounting, as before mentioned, on the penthouse panel board, four, six-circuit multi-breakers, each controlled by a separate magnetic contactor. Each contactor was then remotely controlled by vaporproof off and on buttons located on each end of the row, making it possible to open or close the contactor from either location, controlling the flow of current through the contactor, through the breaker and then to each circuit. This method was repeated for each section of two rows.

Lighting and power sub-feeders across the roof. Right is 3-inch pipe for 350,000 CM lighting cable; center, 1½-in. pipe for 00, 480-v. power sub-feeder, distance 200 ft.



The end rows of lights between the entrances are switched separately from the general lighting. We installed a contactor and two-circuit multi-breaker for each end and vaporproof off and on buttons at each door to the room. This enables the energizing of either row of lights from any door.

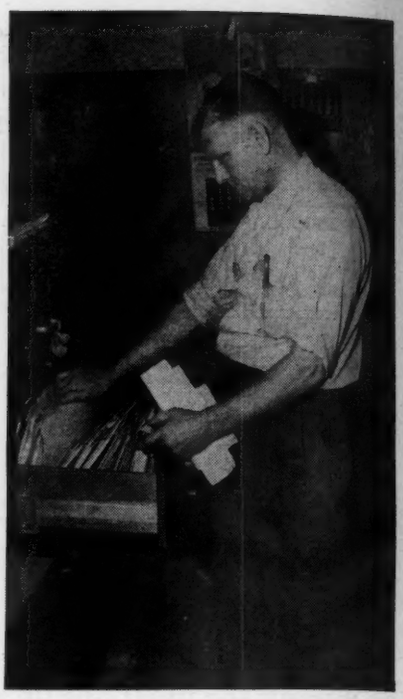
The energizing of the four motors of the refrigeration blowers in this room entailed a home run to each unit from the penthouse. Again, vaporproof start and stop stations installed alongside each motor remotely control the magnetic running protection previously installed on the penthouse board.

The dock and yard lighting, controlled by breakers installed in a small

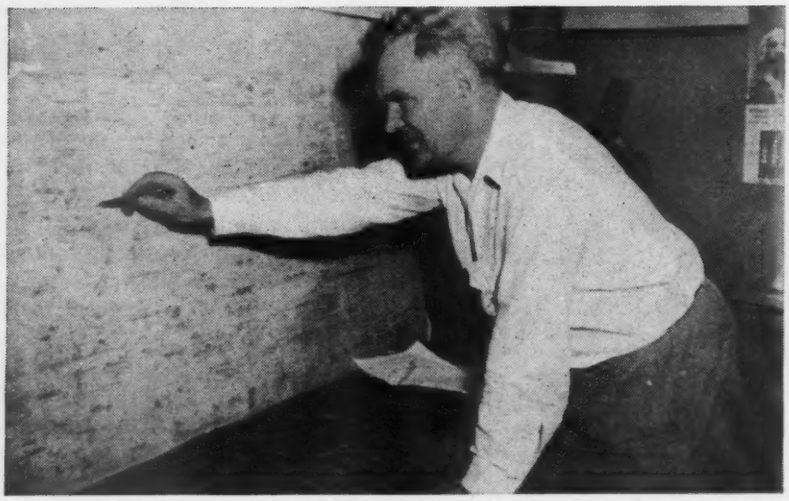
(Continued on Page 180)

Trade-Show Wiring Specialists

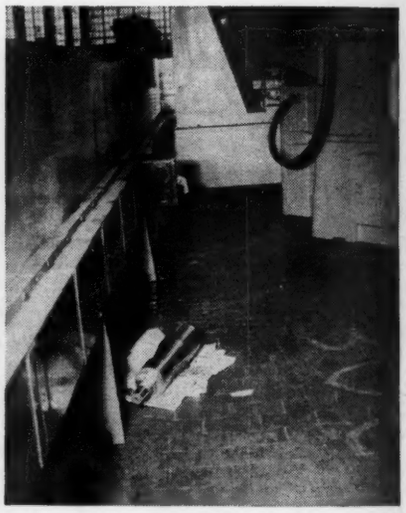
A knack for organization, meeting deadlines and a liberal dash of diplomacy is the recipe for success in the trade-show wiring field.



On-the-job files held 294 folders for individual contracts, blueprints, etc. Electrical foreman George Fritz pulls a file for reference.



Supervising engineer Robert E. Ryan checks electrical requirements of one of 300 booths at Machine Tool Builders show.



Some exhibitors had their own bus duct requiring relatively heavy concealed feeders.

FIFTY or more contracts for a single wiring installation that is actually used only a few days are daily fare for the J. F. Fisher Company, Chicago electrical contractors specializing in trade-show and exposition wiring. They rush a job to completion, maintain it during operation, then rush to tear it down again.

Operating in this field is not as easy as one might believe. Requisites include: A pronounced ability to organize; a patience and diplomatic acumen that will keep a multitude of customers simultaneously happy; a good engineering staff; a knack for working effectively under pressure; and last, but not least, a substantial inventory of sundry electrical equipment and wiring supplies that can be installed on a rental basis.

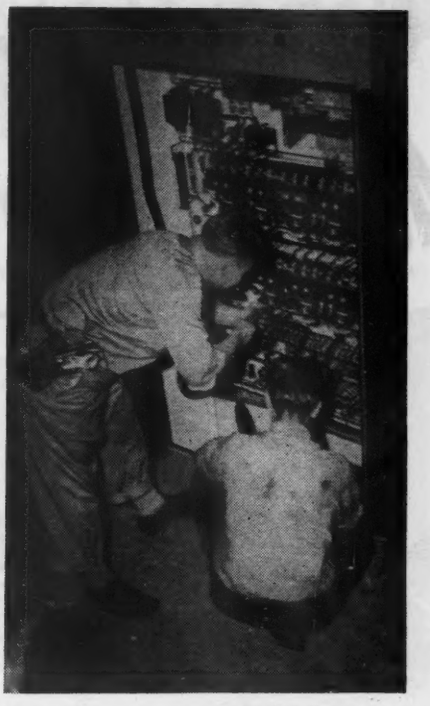
Hotels, auditoriums, large exposition halls and areas are the job sites for Fisher Company activities. They run the gamut from small merchandising exhibits open only a few days to gigantic industrial expositions open for a week or more.

Normally, the Fisher Company is engaged by the exposition or show manager, but bill the individual exhibitors direct for work done in their booths. Hence the unusual condition of multiple contracts for each project covering lighting and power wiring; also dismantling the electrical system when the exhibits close.

Outstanding large scale examples of their work was the 1947 Machine Tool Builders Association Exposition held at the Tucker Plant (formerly the Dodge-Chicago warplant) in Chicago.

Electrical engineer Richard Wessel inspects a "load" of preassembled bus plugs and cable drops before installation.

Existing bus duct distribution facilities were used wherever possible. Numerous machine tools were fed by this concentration of plug-in units.



Electricians set up and check control panel for large horizontal boring, drilling and milling machine exhibited at the show.

Here some 294 different manufacturers used 513,000 square feet of floor space for displaying more than 2,000 new machine tools to 175,000 visitors during the 10-day run. Reputedly the largest industrial show of its kind in the world, the exposition had a connected light and power load of about 20,000 horsepower.

Providing electrical distribution at this show was one of Fisher's largest "temporary" wiring projects. Individual contracts totaled more than $100,000 and included about $75,000 worth of electrical equipment installed on a rental basis. Cost of cleaning and relamping 1,400 mercury and incandescent general lighting fixtures alone (unused since V-J Day) was $10,000. Light and power bills for the 10-day show ran about $16,000 and $30,000 respectively.

Considerable planning went into this project. Immediately upon being chosen by Clapp and Poliak, Inc., New York exhibit managers, Fisher engineers set up their organization. First step was a canvass of each exhibitor to learn his electrical needs and secure a blueprint of his booth setup. As this information came into the Fisher office, individual file folders were assigned to each "customer." A plant survey revealed existing available service and distribution capacity and facilities. With this data at hand, Fisher engineers began to design the "temporary" wiring system, much as a permanent installation is planned.

A large plan view of the exhibit area was used in making the layout. On it were sketched the existing 440-volt, 3-phase bus duct runs (17 300-ft. feeders) and additional feeders needed. Connected horsepower, voltage and number of motors in each booth were noted (motor sizes ran from fractionals to 150 hp.).

For service, the contractors utilized six existing transformer vaults having a total capacity of about 25,000 kva. For distribution existing bus duct was used as well as additional temporary branch circuits, and feeders. About 25 extra transformers (440/220/110-volt) from 15 to 50 kva. capacity were installed to provide voltage for lighting and 220-volt power units. Sixteen 50-hp. and fifty 3-hp. existing fans were serviced and connected to ventilate the area.

In general, bus plugs with cable drops were installed to feed motors. These were cut, assembled and fused in one of the numerous basement washrooms used as contractor's office and shop areas. Mounted on skids or trucks, these were delivered by small tractors to installation areas. Where exhibitors desired, temporary circuits were concealed in the wood block floor (blocks removed and cable covered with metal channel). Individual booth lighting required thousands of feet of stage cable and some 3,000 pigtail sockets. Approximately 1000 pounds of rubber and friction tape were consumed on the project.

Actual installation work began four months prior to the opening of the show and increased in tempo until 100 electricians were busy connecting equipment as it arrived at the plant. Shipment delays necessitated a 77-hour work week just before the opening. During the show, 25 electricians comprised a round-the-clock maintenance crew.

Only once were the electricians stumped: A large machine tool ready for export appeared with all circuit data and electrical instructions in French. Someone who remembered his high school French finally came to the rescue.

With the show over and equipment dismantled and moved, the chore of sending out some 1200 invoices began. And so the cycle repeats itself for another series of exhibits.

Sparkplug, master-mind and moderator of these hectic activities is congenial, energetic Robert E. Ryan, supervising engineer and secretary-treasurer of the Fisher firm. He loves the tension and excitement that goes with the job; wired eleven more shows after the Tool Exposition; has 50 more signed up for 1948, including the gigantic Road Builders Show to be held at Chicago's Soldier Field in July.

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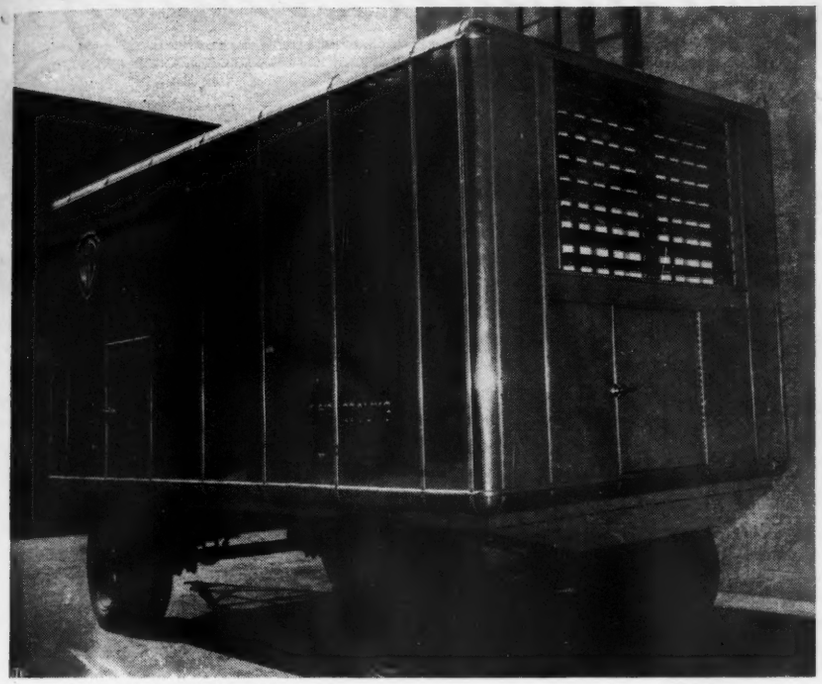
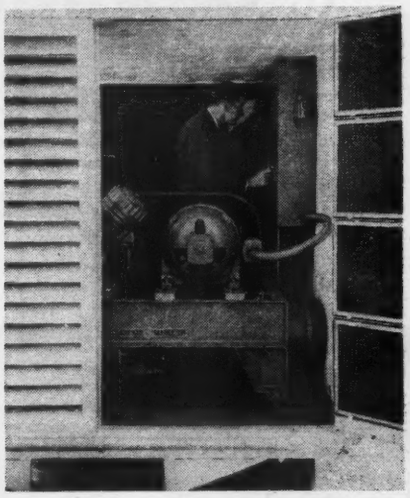
Practical Methods



One of the eight mobile air cooling units now in regular use at Warner Brothers studios shows louvres in rear of trailer for cold air exhaust. Filtered air can be directed upwards or along floor. Unit is self-contained and is equipped with electrical, cooling and waste connections. Control panel, recessed into side of trailer, is seen beneath and to right of W-B monogram.



Jack Reardon, air conditioning engineer for the Hokanson Company, stands before the circuit breaker panel on one of the air cooling units. The panel houses two motor starters (magnetic, across the line), one for 30 hp. compressor motor, the other for the 2-speed blower motor, plus Modutrol control. All switches are circuit breaker type. Filters are seen at right.

Mobile Air Coolers Speed Movie Making

AIR CONDITIONING

A fleet of mobile air conditioning units is solving the problem of excessive temperatures at the Warner Brothers studios in Hollywood, California. The units, designed by the C. G. Hokanson Company of Los Angeles in cooperation with Warner Brothers engineers, were first used during the filming of the Technicolor motion picture, "Life With Father".

Due to the intense heat resulting from the lighting required for Technicolor work, two standard air conditioning units were installed on the stages. Results obtained were so successful that the Hokanson Company was commissioned to design a package mobile unit complete with all necessary components, giving special emphasis to appearance, efficiency and noiseless operation. Eight mobile systems are now in use by the Warner studios and an additional four will be delivered shortly. Costly shutdowns, formerly necessary to permit actors to recuperate from the heat thrown off by the lights, have been eliminated.

Each unit, mounted on a small trailer with readily accessible control panels, contains a 30 hp. General Electric condensing unit which serves two air conditioners mounted at the rear of the chassis. Each conditioner has a capacity of 7500 cfm. Special adjustable vents and louvres at the rear of the unit make it possible to direct high velocity cooled and filtered air either up over the sets at the heat producing lights, or along the floor so that no objectionable air motion will be apparent while the action is being filmed. Two motorized, independently controlled sets of louvres make this possible. In one set, the vanes are horizontal while, in the other, louvres are vertical.

Principal advantage of these units is their great mobility and the self-contained trailers can be easily shifted as the action moves from stage to stage. This method of air conditioning, known as "spot cooling", is definitely an economical investment for 60 tons of mobile cooling equipment can now accomplish the equivalent of 500 tons of refrigeration developed in a central plant. The great amount of heat producing light is apparent by considering the dimensions of the stages, often 90,000 square feet in area with 65- to 90-foot ceilings.

Engineers predict wide use for the design in auditoriums, indoor sport arenas, circus tents and similar places where crowds are large but infrequent, and weather conditions are hot and humid. Favorable considerations are flexibility, low unit cost and mobility.

Equipment consists of a 30 hp. Freon

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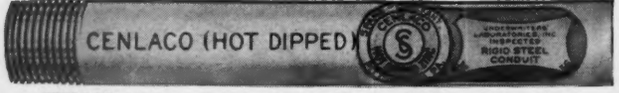

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water-cooled compressor, 220 volts, 3 phase, 60 cycles; two 66-inch by 29-inch coils of special design; sixteen 16 by 20-inch vortex filters for screening incoming air, and two sets of motorized directional louvres. The entire unit is mounted on a four-wheel, eight-tired truck, with setting handbrake. Vacuum brakes are installed for road operation. Body and doors are of aluminum mounted on steel frames. The body is soundproofed for silence with sprayed-on rubber adhesive being used. Special compressor mountings are employed for soundproof floors. Mineral wool is used for thermal insulation.

Electronic Color Matching

PRODUCTION

To simplify the matching of porcelain enamel and glass colors and to provide a constant quality control check, the Pemco Corporation of Baltimore, Maryland, has installed a recording photoelectric spectrophotometer. The instrument, produced by General Electric, can measure and record as curves on a graph over two million shades of color and is expected to save from two-thirds to three-fourths of the time needed to match colors, measured by standards established by the methods formerly used. Previous methods, which were visual, were often inaccurate due to colors changing under different lighting.

Pemco, manufacturers of porcelain enamel, glass colors and the raw material making up porcelain enamel before it is fused to metal, frequently is requested to produce colors to match samples submitted by customers. Prior to the use of the spectrophotometer, visual comparison was the method employed and frequent inaccuracies resulted due to the different appearance of colors under varying lighting conditions when viewed by different inspectors.

Since the application of the spectrophotometer, a library of over 1000 color curves of known composition has been established. When a customer submits a sample color, it is analysed by the spectrophotometer and the resulting color curve is matched as closely as possible with one of the curves in the library. An experienced color mixer then selects the required ingredients, varying the amounts so that both curves, and therefore both colors, match perfectly. Comparisons are accurate and fast, physiological factors are eliminated and the factors of human judgment become subordinated to the positive analysis of the meter.

Operation of the spectrophotometer is simple, consisting of inserting the color sample and a standard in their respective holders, placing the recording paper on a drum, and selecting the correct recording speed.

Glass and porcelain enamel colors are matched accurately and rapidly in the Pemco Baltimore plant with the use of a G. E. spectrophotometer. Over two million shades of color can be measured and recorded as curves on a graph. Human judgment is replaced by the positive analysis of the unit. The time required to match color samples has been reduced by over 60 percent through the use of this machine.

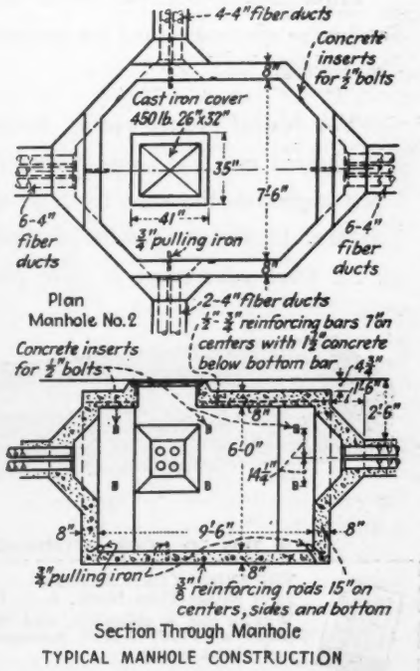
Octagonal Design Cuts Manhole Cost

DESIGN

Concrete manhole construction for underground electrical conduits may become a sizable cost item in an industrial electrical distribution system, particularly where numerous large conduits and cables are involved. Prudent design, however, can substantially reduce manhole costs without affecting working area requirements and structural soundness.

One more or less undesirable feature of the conventional rectangular concrete manhole is the amount of waste space in the corner areas that is merely bridged by cables racked in the manhole. To eliminate this, Sweningson & Company, enterprising Chicago electrical contracting and engineering firm, designed an octagonal manhole for a recent industrial installation. Besides reducing the amount of concrete and excavation required, this design simplified cable racking by providing better anchorage facilities for the long, easy sweeps needed to offset large cables, which must be routed from one duct line to another in the close quarters of the manhole. The sketch below illustrates this feature in plan and section.

An additional refinement further reduced the overall dimensions of the manhole. Wherever conduits enter or



TYPICAL MANHOLE CONSTRUCTION

Plan and sectional view of octagonal manhole. Note large inverted bell-type protrusions in walls that permit large cable sweeps. Octagonal design eliminates wasteful corner spaces; provides additional cable racking facilities.

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says *Frank A. Blesso, Wholesaler*
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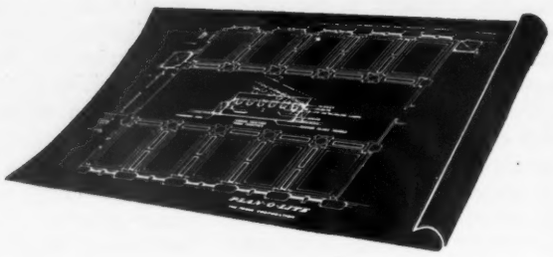

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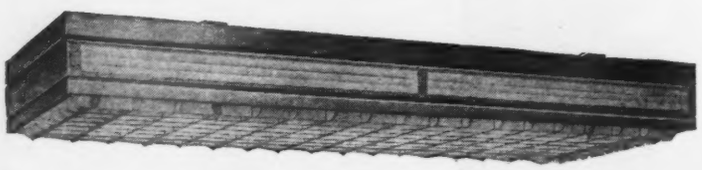

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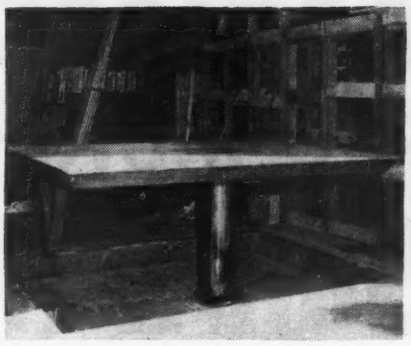
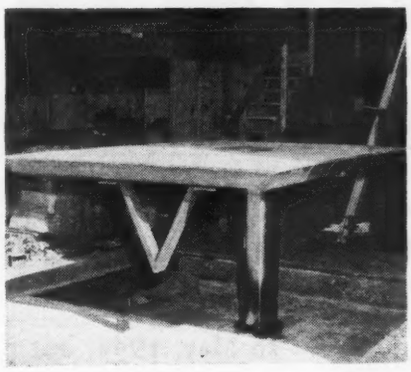
leave the enclosure, bell-type protrusions were incorporated in the concrete walls. These effected a reduction of some three feet in length and two feet in width of the octagonal manhole; permitted the cable sweep to begin beyond the vertical walls.

Although the carpenter work may run higher on forms for this type of manhole, this specific cost is offset by the other features. Sweningson engineers report savings of from 10 to 15 percent on the overall manhole cost (excavation, forms, concrete, cover, backfill) compared to the conventional rectangular unit. Added to this are the economies in cable installation and racking permitted by this specific design.

Another Sweningson design feature is to be incorporated in units installed where anticipated future conduit lines may enter or leave the manhole. At these points, concrete wall thickness will be reduced about 50 percent and the reinforcing rod will be offset to form a frame around the proposed future opening in the manhole wall. In effect, it will be a large "knockout" in the wall that can be quickly and easily chipped out. Instead of drilling through an eight-inch wall with its intermeshed reinforcing rods, it will be clear sailing through four inches of plain concrete.



Hydraulic lift, for loading and unloading trucks, in normal operating position at the S. C. Sachs Company shop in St. Louis. Note V-shaped guide (left) which provides self-aligning feature by engaging pocket in pit floor as platform descends. Eliminates chances of catching fingers between lift and floor.



In this position, platform extends beyond building walls to accommodate trucks too high to enter building. Off-center mounting of platform on lift piston permits this.

View of under side of lift showing how conventional service station unit was modified to accommodate steel platform for truck loading purposes.

Hydraulic Lift for Truck Unloading

SHOP

Reduction in the time required to handle materials and equipment in the contractor's shop is just as important as high production efficiency on the job. That is the operating philosophy of S. C. Sachs, president, S. C. Sachs Company, one of St. Louis' largest electrical contracting and engineering firms.

When a customer engages a contractor, he is buying engineering talent, purchasing and construction experience, installation "know-how", labor management talent, and service. To offer the type of service to which a customer is entitled, the contractor must have an efficient organization in and out of the shop. Men and materials must be sent to the job when and where needed.

Backbone of S. C. Sachs Company service (in addition to a staff of some 12 electrical engineers) is a tool and construction materials inventory valued at more than one-quarter million dollars. Included are heavy power construction tools, large reels of heavy cable, standard lengths of bus duct, conduit, switchgear, and even fluorescent fixtures. Thus, when a contract is signed, enough material can be sent immediately to start the job and keep it going until specific job material orders are delivered. Items sent to the job are always replaced from original contract orders so the stock level is constantly maintained.

Providing this type of service requires an efficient materials handling system. With the heavy equipment items stored and used, truck loading and unloading could require a substantial amount of shop time. Efficiency minded S. C. Sachs has reduced this possibility to an absolute minimum by installing a hydraulic lift at the truck entrance to the shop.

The unit is a standard service station type with platform modifications to meet truck loading needs. The platform is an 8-ft. by 6-ft. section of ¼-inch non-skid steel plate welded to a heavy I-beam frame. A bevel edge-plate on four sides is formed by lengths of sheet steel (about 4 inches wide) welded to the platform and a rectangular angle-iron frame on the platform beams. This helps seat the lift in the shallow floor pit when at floor level.

Accurate self-alignment of the platform as it approaches floor level is provided by a large V-shaped channel-iron guide which Sachs' mechanics welded under one end of the frame. As the lift descends, a mechanic guides it into position by hand. About 18 inches above floor level, the self-aligning guide takes over. The channel "V" enters a pocket in the pit floor and swings the platform into position as it continues to descend. No chance of crushed fingers or hands with this device.

The platform can be rotated 360 degrees, hence can be aligned flush with a truck body and floor at almost any angle the truck might enter the building. It is mounted off-center on the lift piston. Thus, in one position (with the V-guide to the front) the platform extends slightly beyond the building walls to accommodate trucks that cannot enter the building because of height. One mechanic operating a couple of levers can raise or lower the lift and stop it at any height to meet various truck floor levels.

Prime reason for installing the lift was for loading and unloading large reels of heavy cable. Formerly this required truck skids, block and tackle and at least four men for 20 to 30 minutes. A slip usually meant a crushed or damaged reel. Now the lift is merely raised to truck level, the reel rolled on and blocked, the lift lowered and the reel rolled to its storage space, all within a few minutes and with only two men. The same is true for other heavy equipment. Also, by cutting loading and unloading time, the truck entrance can be kept open for whatever emergency or quick-deliveries may arise.

Use of the unit need not be confined to bulky materials. Conduit, bus duct, power tools and "package" items can be loaded in a jiffy.

Avoid Needless Losses
Due to Motor Burnouts
Protect Small Motors
As Well As Large Ones

with BUSS

Here's Proof That It Pays To Protect Small Motors

What is the FUSETRON?

The Fusetron is a DUAL element device — a Fuse to which is added a Thermal cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

"In May, 1944, our progress in filling a contract for white uniforms was being seriously interfered with by motor burnouts and fuse blows on our power sewing machines. Each of these machines is driven by a half h. p. three phase 220 volt 2.3 ampere motor. Ordinary one-time fuses were then used. When the correct size fuse was used, it frequently blew when operators started their machines under load with the clutch out. Single phasing frequently resulted and then the motor was usually burned out before the fuse could be replaced. Our master mechanic was spending so much time replacing fuses that he began to use the maximum size he could get in the holder, 30 ampere, which, of course, resulted in still more burned out motors.

"About that time the President and General Manager of our company, wrote for information on Fusetrons. 2½ ampere Fusetrons were recommended. We had them installed at once.

"In July, 1945, our Superintendent reported that not one motor had been lost since Fusetrons were installed — and that the saving in man hours formerly wasted while burned out motors or fuses were replaced had helped us to fill our orders on schedule."

(A large southern manufacturer—name on request)

Fusetrons Prevent Shutdowns—Save Costs

The cost of installing Fusetrons is mighty small compared to the losses incurred when a motor burns out. You have not only the cost of removing and replacing the burned-out motor, but the cost of the shutdown as well.

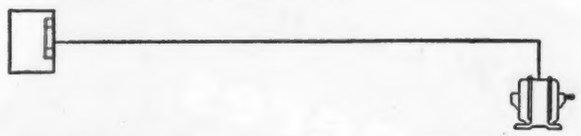
It will pay you to guard against these double losses by installing Fusetrons on small motor circuits such as pumps, fans, blowers, compressors, conveyors, mixers, grinders, stokers, oil burners — and hundreds of others.

FUSETRONS

Simple to Install

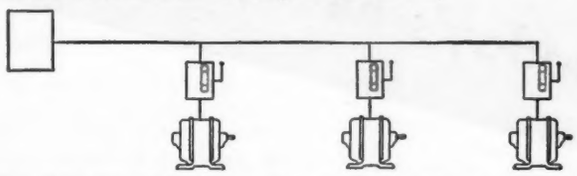
Just install a Fusetron of motor-running protection size anywhere in the circuit to handle only the motor current. Then on all normal installations, the motor will be protected against burnout due to lack of oil, worn bearings, tight belt, overloading — or anything that causes a dangerous excess of current through the motor.

If the motor is on a separate circuit,



a Fusetron of proper size in the switch or panelboard protects the motor and the circuit wiring.

If the motor is on a circuit feeding several motors,



install a Fusetron of motor-running protection size to protect each motor.

That's how simple it is to protect your motors from burnout — and yourself from losses due to motor burnout.

Fusetrons Give Many Other Kinds of Protection Heretofore Not Available

Fusetrons do everything fuses do, as is confirmed by Underwriters' Laboratories Label, and in addition . . .

✱ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads. ✱ Give Thermal Protection to Panelboards and Switches. ✱ Lesser resistance means cooler operation and prevents needless blows caused by heating in panels and switches. ✱ Permit use of larger motor or adding more motors on circuit WITHOUT installing larger switch or panel. ✱ On new installations, PROPER size switches and panels can be used instead of OVERSIZE. ✱ Protect small motors against burnout simply and inexpensively. ✱ Give DOUBLE protection to large motors. ✱ Provide simplest way to stop burnouts from single phasing. ✱ Protect coils, transformers and solenoids against burnout.

Get All the Facts—Get Better Protection—Send the Coupon Now!

Even one lost motor, or one needless shutdown or one destroyed panel may cost you far more than replacing every fuse with a FUSETRON.

Don't risk such losses — protect yourself by changing over the fuses in your entire electrical system to FUSETRONS.

BUSSMANN MFG. COMPANY
University at Jefferson, St. Louis 7, Mo.
(Division McGraw Electric Company)

BUSS FUSETRONS—SOLD THROUGH WHOLESALERS

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

EC&M2-48

Silent

10 amperes

Sure, selling a top-quality wiring job is a tough deal when customers can't tell an ampere from an ohm. But here's a brand-new focal point for your sales story—silence and smooth action —*features you can demonstrate!*

With its new 10-ampere, 125 volts, T-rating, this new mercury switch opens up new fields for silent switch applications, matches quiet operation to today's heavy loads. It's a long-life, specification-grade switch, made well to do its job well — *another G-E first* — to help you sell more top-notch wiring jobs.

And, when you're talking high-quality wiring, remember the selling power of the General Electric name. It identifies a complete line of wiring devices which your customers know they can trust. Ask your General Electric merchandise distributor about the new mercury switch and the rest of this complete line. Section D1–218, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC

Equipment News

Air Circuit Breaker

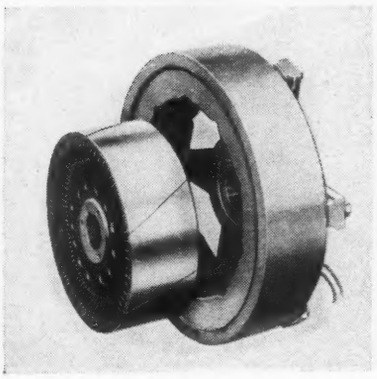
A new air circuit breaker, Type AK-1, designed for use on low voltage circuits (600 volts and below) has been developed. It is available in two ratings. The AK-1-15 is rated 15 to 225 amperes with a 15,000 ampere interrupting rating. The AK-1-25 is rated 35 to 600 amperes with a 25,000 ampere interrupting rating. Features include improved arc interruption, accessories readily attached in the field, compact, sealed-in overload trips, short-time rating equal to the interrupting rating, complete shielding of live parts, and an all metal mounting base. Breaker can be supplied either for individual mounting or as an integral part of draw-out switchgear equipments. It is available for electrical or manual operation. General Electric Co., Schenectady 5, N. Y.

Island Light

A new all purpose island light which uses a base-up lamp has been introduced. Unit features a wiring trough with lamp-holders which makes it adaptable to a wide variety of auxiliary lighting services such as are used for advertising displays, building illuminations, approach lighting or for supporting an integrated display piece. Unit is for high or low mounting. Lamp has weather protection for wiring and sockets. Bright Light Reflector Company, Fairfield and State Streets, Bridgeport 5, Conn.

Transformers

A line of adjustable phase shifting transformers that will convert standard watt-hour meters to kva-hour meters by the displaced voltage method has been announced. They shift the voltages by 0, 30, 45, and 60 degrees corresponding to 100, 86.6, 70.7 and 50 percent power factor respectively depending upon position of movable plugs inserted in radio-type sockets built into the units. Use of the transformers is based on the fact that by shifting the phase angle of the voltage a proper amount, any watthour meter can be made to read kilovolt-ampere hours. Five types of transformers are available: type K-12 for two phase, three wire connections; K-13 for three phase, three wire; K-14 and K-18 for three phase, four wire; and K-17 for three phase, four wire delta. Westinghouse Electric Corp., Pittsburgh 30, Pa.



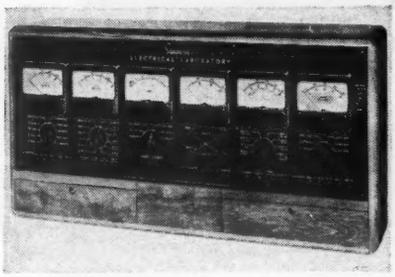
Crane Control

Revolutionary new control principle for a-c cranes provides comparably flat speed control characteristics both for lowering and raising. Called "Magnetorque", the unit is an eddy-current brake mounted to the motor pinion extension shaft; pre-loads hoist motor at all times providing satisfactory speed regulation of a-c slip ring motor under light and no load conditions. Brake consists of a stationary field ring bolted to gear case and a rotor coupled to the pinion shaft. Excitation for d-c field produced by step down transformer and selenium rectifier. With full magnetic control it provides five steps of regulation up and down; with drum control, seven steps up and eight steps down. If Magnetorque current fails, current relay opens automatically disconnecting hoist motor from line and setting electric motor brake. Harnischfeger Corporation, 4400 West National Ave., Milwaukee 14, Wis.

Rectifier

A new line of low voltage high current rectifiers is now available for operation from 220 or 440 volts three phase a-c

power lines. D-c output voltage can be varied from 0 to 6 volts, with a capacity of 600 amperes, or from 0 to 12 volts with a capacity of 300 amperes. Features are—selenium rectifier elements, thoroughly sealed; heavy duty variable voltage transformer; each unit includes 4½ inch ammeter and voltmeter and protection against over-loads and failure of ventilation system. Mellaphone Electronic Rectifier Co., Inc., Rochester 2, N. Y.



Instrument

A new multiple purpose test instrument for use by radio, electronic and electrical technicians in laboratories, shops or service departments. It consists of six individual 4½ inch rectangular instruments, each with a complete set of ranges. A multi-range ohmmeter and a single phase wattmeter have been included. An instrument is provided with a sensitivity of 50 microamperes, providing 20,000 ohms per volt on all d-c voltage ranges. It incorporates a rectifier type instrument for measuring a-c voltage with a resistance of 1,000 ohms per volt on all ranges. All of the instruments are indirectly illuminated, and all lights are controlled by one switch located at the right side of the panel. Simpson Electric Company, 5218 W. Kinzie St., Chicago 44, Ill.

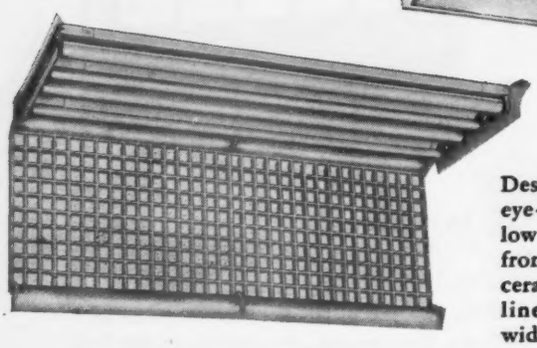
THE *New* ACHIEVEMENT BY ALL-BRIGHT!

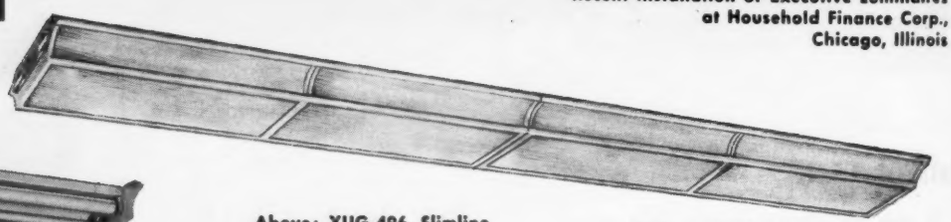
Recent installation of Executive Luminaires at Household Finance Corp., Chicago, Illinois

THE *Executive Luminaires*

Designed for Beauty, Efficiency and Performance

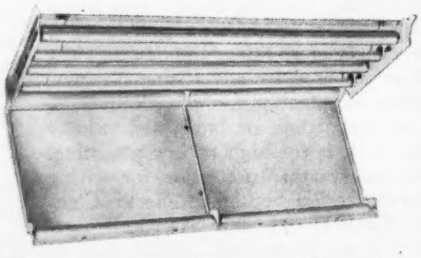
Below: XUL-440, Louvered





Above: XUG-496, Slimline

Below: XUG-440, Fluorescent



Designed for modernization plus eye-appeal, these extremely shallow units have an overall depth of from 3½ in. to 5 in. Convex glass ceramic finish side panels streamline these fixtures and provide wide illumination distribution.

Fluorescent Fixture Data						
Lamps				Approx. Dimensions		
Cat. No.	No.	Watt	Line Volts	Length	Width	Height
XUG-240	2	40	118	48⅛	14	3¾
XUG-440	4	40	118	48⅛	21	3¾
XUL-240	2	40	118	48⅛	14	4¼
XUL-440	4	40	118	48⅛	21	4¼
Slimline Fixture Data						
XUG-296	2	51	118	96⅛	14	4¾
XUG-496	4	51	118	96⅛	21	4¾
XUL-296	2	51	118	96⅛	14	5
XUL-496	4	51	118	96⅛	21	5

Ease of Maintenance... Removable or hinged cradle contains side panels and louvre or bottom glass. Easy accessibility to component parts or wiring by two slide catches which lower reflector. *Construction*... Heavy gauge metal reinforced K.O.'s provided. *Finish*... Durable baked white enamel, reflection factor 87%. *Wiring*... Wired complete, 110-120 volts, 60 cycle A.C. *Certified*... Approved by Underwriters' Laboratories, Inc., Wiring and Fabricated, A. F. of L.

There is only *one* manufacturer of All-bright fixtures. We have no affiliation with any other manufacturer of lighting fixtures.
Trademark Registered.

ALL-BRIGHT ELECTRIC PRODUCTS COMPANY

Manufacturers of Fluorescent Lighting Fixtures

LIGHT RIGHT WITH All-bright

3917-25 N. Kedzie Ave., Chicago 18, Illinois

Gearmotor

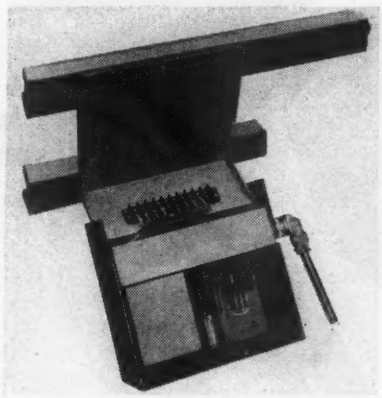
A new vertical gearmotor has been added to this line of gear drives. Each unit is a self-contained drive, consisting of a high speed motor and speed reducing unit. Nine different gear ratio combinations are available, ranging from 7.61:1 to 38.9:1. They are available in 3 to 50 hp., 220, 440 or 550 volt, 3 phase, a-c, and 3 to 7½ hp., 115 or 230 volt, d-c. They may be equipped with practically any standard motor in a variety of enclosure types including: open protected, semi or totally enclosed and explosion proof. Special features are—design of gear case is such that all gears and bearings receive positive lubrication at all operating speeds; quiet operation; maximum strength and tooth overlap; uniform loading; and lower impact stresses from sudden shocks or reversals. Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Broadcast Station Light

A new indicator light, Type "Q", designed especially for radio broadcasting stations, film studios and applications where controlled warning lights are required, has been developed. It is available in 24 volt, 15 cp or 110 volt, 10 watt. The light may be wired in multiple for several locations so that all will operate simultaneously. Manual or automatic timer controls are not furnished except by special order. The light measures 16 by 6 by 4⅛ inches. Lights may be combinations red, green, blue, amber or opal. Cannon Electric Development Co., 3209 Humboldt Street, Los Angeles 31, Calif.

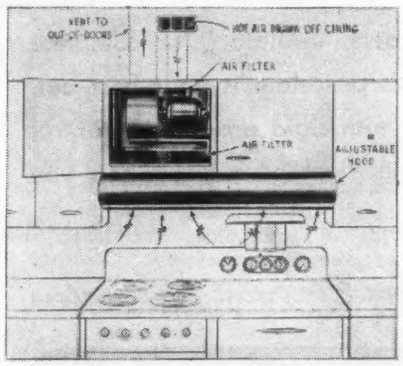
Receptacle

New keyless ceiling receptacles for use with 3½ inch and 4 inch round boxes have been introduced. They are designed with extra strong terminals and permit the use of No. 10 aluminum wire or No. 12 copper wire, as required, using large binding head screws. They are of bakelite construction. Comes complete with washer head screws and mounting. They carry Underwriters' Laboratories approval. Slater Electric and Manufacturing Co., 37th Ave., & 56th St., Woodside, N. Y.



Control Amplifier

A new series, PR-400, of photo electric control amplifiers has been announced. They are designed for industrial applications where a change in the intensity of light on a phototube, translated into power switching, is used to accomplish automatic control of machinery or to serve as an indicator or warning device. All models contain a small control panel easily accessible behind a hinged door in the front of the case. Adjustments are: sensitivity control; timing regulator; manual reset switch; on-off power switch; and Neon indicator lamp. The 400 series is built in two parts: the case, containing the control-amplifier unit; and the base, with mounting holes and knockouts for electrical fittings. The case contains a terminal board to which all outside wiring is connected. Operates on 115-230 volts, 50-60 cycles a-c. Langevin Manufacturing Corporation, 37 West 65th Street, New York 23, N. Y.



Kitchen Ventilator

A new type kitchen ventilator which can be located within a wall cabinet above the range has been announced. Known as the Super Clipper Type K, it is a complete package unit ready for installation, and has an adjustable hood which is drawn out to pick up all smoke and grease from the entire range top. A grille near the ceiling also draws excess heat from the room. Air filters which can be removed for cleaning are provided for both inlets and the assembly is sound proofed within a metal housing. It will fit any wood or metal cabinet that provides a space 18 inches high by 12 inches deep by 21 inches wide. The hood is 42 inches wide. Unit is driven by a ½ hp. motor and is provided with a variable air control up to 600 CFM. Trade-Wind Motorfans, Inc., 5725 S. Main St., Los Angeles 37, Calif.

Time Switch

A new Type S time switch has been announced. The overall dimensions are approximately 3 in. wide, 5⅜ in. high and 3-in. deep. It is powered by a newly developed high torque, synchronous, self-starting, low speed motor that is lubricated for life. The switch is designed for easy mounting on a standard switch box, or for surface mounting on any wall. It carries the approval of Underwriters Laboratories. Switch is available in two colors—ivory or brown. Sangamo Electric Company, Springfield, Ill.

Troffer Luminaires

A new troffer luminaire designed to give a wide choice of decorative lighting effects has been announced. Available for one 40 watt, one 100 watt or two 40 watt fluorescent lamps, they can be shielded by egg-crate louvers, cross baffles, glass door, or left open without additional shielding. Troffers are 12 inches wide and either 48 inches long for 40 watt lamps or 60 inches long for the 100 watt size. They can be installed in any standard suspended ceiling in which a suitable metal or wood frame is provided. All lamp operating equipment such as shields, electrical assembly including ballasts, and reflector can be removed from or installed in the housing while it is in place on the ceiling. Westinghouse Electric Corporation, Pittsburgh 30, Pa.

GUY STRAIN INSULATORS

ILLINOIS wet process insulators are made from highest grade materials under complete plant control. Internal stresses eliminated through careful, constant-temperature firing. Available in large stocks of standard sizes.

WIREHOLDER INSULATORS

The insulators you want for permanent installations. Hot galvanized all-steel screws have deep, sharp threads, permanently bound to insulators with non-shrinking metal alloy. Smooth, rounded surfaces protect wire insulation. Sufficient sizes and styles to meet all requirements.

WHEN IT COMES TO PORCELAIN.. *Specify* ILLINOIS

WHETHER for wireholders, insulators, or complete wiring systems, Illinois porcelain is your best bet. Years of experience combined with rigid production control bring you the very best in electrical porcelain when you buy ILLINOIS.

Sold only through Recognized Electrical Wholesalers

STANDARD TUBES

Glazed, unglazed, split, floor, split floor, headless, curved, crossover split, and crossover. Uniform inside and outside diameters. Sizes 1/2 to 48" long, 5/16 to 3" diameter.

Bull Dog

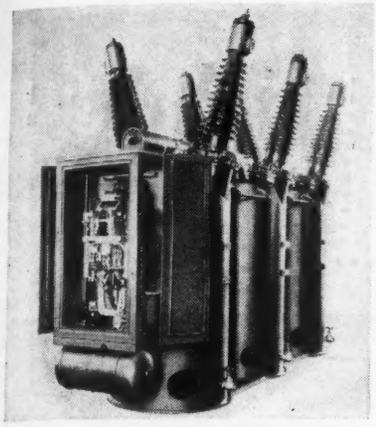
KNOBS

Knobs that don't chip when installed. Cement coated, extra length nail—genuine leather washer—code standard. Wide variety of sizes.

CLEATS

Standard cleats of all sizes and types.

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS



Circuit Breakers

An improved line of high voltage, high speed, quick clearing (5 cycle), outdoor, floor mounted oil circuit breakers, Type BXO-160, has been announced. These redesigned units in ratings from 115 kv. to 230 kv. up to 3,500,000 kva. interrupting capacity, meet the requirements for high voltage transmission line circuit breaker protection. Features retained in the breaker include single break, 5 cycle Ruptor arc extinguishing devices, and the improved pneumatic operator with self-contained automatic air supply system. External conduit on the side of the breaker has been eliminated. Other improvements include a weatherproof mechanism box on top of each tank, an improved oil and gas seal for pole unit tanks; provisions for removing either bushings or bushing current transformers without disturbing the other. Color coded wire is furnished for leads permitting easy transformer tap changing when necessary. Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Fluorescent Fixture

A new commercial fluorescent lighting fixture, known as "Arrowhead", features a plastic louver. The manufacturers claim this to be the first commercial unit to feature controlled brightness without contrast. The low surface brightness equals about one candlepower per square inch on the sides. The all-plastic louvers are self-locking and non-warping. Ballast is enclosed in steel channel. Holdenline Company, 2301 Scranton Road, Cleveland, Ohio.

Rotating Beacon

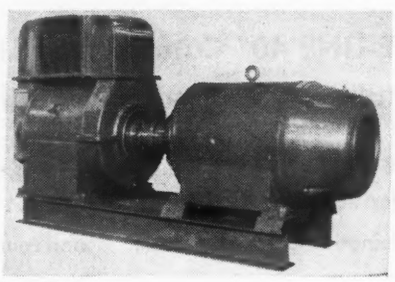
A 100,000 candle power rotating beacon for small airports or small seaplane bases has been announced. It is equipped with a transfer relay so that if the service lamp burns out, an auxiliary lamp is turned on instantly and an indicator contact is closed to give warning that the service lamp must be replaced. The relay resets automatically when the service lamp is replaced or in case of accidental trip-out of the switch during maintenance. The beacon is totally enclosed under a rubber gasketed glass dome and can be operated in any climate since it is not affected by sleet, rain, or temperatures. Two identical optical systems, each consisting of four doublet lens arranged in pairs project two concentrated beams 180 degrees apart for ten mile visibility under normal flying conditions when a 500 watt airway beacon lamp is used. The revolving beacon operates on any 115 volt, 60 cycle supply. Westinghouse Electric Corp., Pittsburgh 30, Pa.

Fluorescent Fixture

The Executive luminaries have been added to this line of fluorescent lighting fixtures. The over-all depth of fixture is 3½ inches. The bottom glass or louvre is mounted in a cradle that hinges on either side, permitting easy accessibility to parts and wiring. Fixtures may be mounted individually or in continuous rows and either stem-mounted or flush to ceiling. Available for two or four 40 watt lamps. All-bright Electric Products Company, 3917 North Kedzie Avenue, Chicago 18, Ill.

Gearmotor

This new gearmotor is a compact unit consisting of the Electra-motor and a right angle single reduction wormgear type speed reducer. Housings are of light weight alloy aluminum of high tensile strength. Gear and motor housing is one piece construction. Adaptability to any mounting requirement is provided by concentric bolt holes which permit assembly of unit in four different positions. Electra Motors, Inc., 1110 N. Lemon Street, Anaheim, Calif.



Generator

A new line of totally-enclosed, unit-cooled generators has been announced for use in motor-generator sets or in other generating applications in any non-hazardous atmosphere where the ratings involved make totally-enclosed fan-cooled construction impractical. They are available in ratings from 30 to 150 kw., and especially suitable for use in atmospheres commonly found in steel mills, cement mills, paper mills, and around large machine tools. Cooling of the generator is accomplished by an air-to-air surface cooler which maintains safe winding temperatures at all times. General Electric Co., Schenectady, N. Y.

New Equipment Briefs

Mathias Klein & Sons, Chicago has introduced a new **co-axial cutter** that shears and flattens cable ends in one operation. It has a convex blade working against a straight blade.

A **fluorescent lighting fixture** known as "Louvre Queen" has been announced by Centralite Company, Cincinnati. It uses four 40 watt lamps and can be suspended or surface mounted individually or in continuous line.

The Robot-Lite, made by Theodore Bargman Company, Detroit, is an automatic **pushbutton switch**, which turns the light on and off by the means of opening and closing the door at the installation. * * Kato Engineering Company, Mankato, Minn. has developed a new 2500 watt a-c **light plant.** It is self-excited, cranks from 24 volts of battery. Furnished with full automatic or remote control. * * A hand-held **electric tachometer** is designed to give accurate and direct readings of linear speeds from 10 to 10,000 fpm., and of rotational speeds from 100 to 10,000 rpm. It is made by General Electric Company, Schenectady.

Assembly Products Inc., Chagrin Falls, Ohio has announced a **panel meter** with crystal clear plastic case. Meter is illuminated from front or rear. Meters are built in rectifier type and thermocouple high frequency and pyrometer instruments. * * A **fluorescent fixture,** the Dayliter, is a shallow, louvered unit for two 40 watt lamps. It may be mounted individually or continuously; flush to ceiling or suspended. For use in schools, offices, stores and institutions. Smithcraft Lighting Division, Chelsea, Mass. * * New 25 kvar. pyranol distribution **capacitor** units for individual and group pole mounting, similar to the individual pole type 10 and 15 kvar. units have been announced by General Electric Company, Schenectady.

Lighting surges and temporary heavy loads within the permissible range of transformer thermal capacities, can be carried safely by a new line of primary distribution **fuses** developed by Westinghouse Electric Corp., Pittsburgh. * * The air throughout the entire house can be cleansed electronically by the **home precipitator** developed by Raytheon Manufacturing Co., Waltham, Mass. * * A new multi-contact a-c relay designed for appliances is available in ratings of 5 amp, 115 volts a-c or 5 amp. 24 volts a-c from the General Electric Company, Schenectady.

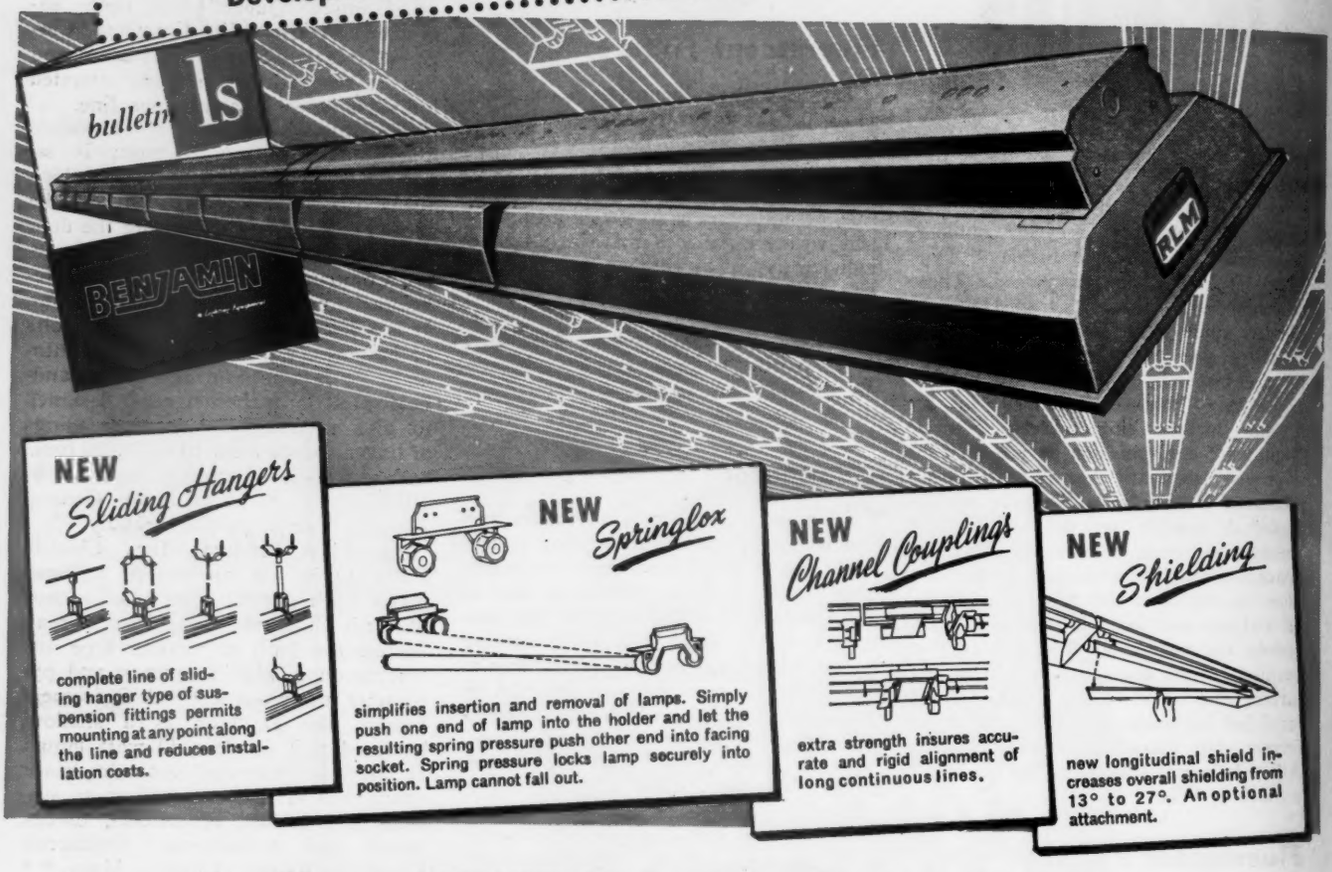
Main service protection and subfeeder units are provided in one **switchboard** for electrical distribution, with provisions for utility's meter, current transformers, test facilities, by Mul-

[Continued on page 140]

NEW advancements in

the Most Modern Way of Lighting!

New Benjamin "Lite-Line 40" System Features Exclusive Developments in Continuous Line Lighting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NEW Sliding Hangers
complete line of sliding hanger type of suspension fittings permits mounting at any point along the line and reduces installation costs.
NEW Springlox
simplifies insertion and removal of lamps. Simply push one end of lamp into the holder and let the resulting spring pressure push other end into facing socket. Spring pressure locks lamp securely into position. Lamp cannot fall out.
NEW Channel Couplings
extra strength insures accurate and rigid alignment of long continuous lines.
NEW Shielding
new longitudinal shield increases overall shielding from 13° to 27°. An optional attachment.

New 28-page "LITE-LINE 40" Catalog and Lighting Manual Shows How to Obtain MORE Productive Lighting at LOWER Overall Cost!

"Lite-Line 40" gives further impetus to the use of continuous lines of light for economical, efficient, high level fluorescent illumination of work places.

For the advancements embodied in the "Lite-Line 40" System are designed to make possible even greater savings in installation . . . even easier and more economical maintenance . . . even greater suspension strength and alignment rigidity . . . further minimization of direct lamp glare . . . and much . . . much easier lamp insertion and removal. Further, "Lite-Lines" are now available in two reflector widths—Type A (11½" wide) and Type E (13⅛" wide).

Complete specifications and design data for "Lite-Line 40" System are provided in the new 28-page bulletin just off the press. Contains detailed dimensional data, descriptions and illustrations of suspension fittings and charts to simplify planning installations and preparing specifications. **FOR YOUR COMPLIMENTARY COPY, write for BULLETIN LS., BENJAMIN ELECTRIC MFG. CO., DEPT. H, DES PLAINES, ILLINOIS.** R-2413-RR.

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Operational Efficiency Tests on D-C Motors

By J. H. Hosmer
Electrical Engineer
Allis-Chalmers Mfg. Co.
Norwood, Ohio

ALL rotating electrical equipment has certain inherent mechanical and electrical losses that enter into every calculation of operating efficiency. For direct current equipment, the mechanical losses include: Bearing friction, brush friction and windage (friction of rotating armature against air). Among the electrical losses are: Iron losses (hysterisis and eddy currents); copper losses (I^2R losses in armature, field windings, and shunt field rheostat); and brush contact losses.

Accurate determination of such losses is an important function of every motor manufacturer's test department. Hence the need for elaborate test equipment layouts. Similar tests are made by many motor repair shops, particularly those engaged in the type of rewinding and rebuilding that may change the rating and operating characteristics of the equipment. The amount and complexity of test equipment in the repair shop depends upon the type of equipment handled and the type of repair work done.

To help electrical repairmen obtain a better working knowledge of direct current motor and generator operational efficiency testing the following procedure is reviewed.

1. *Location of Full-Load Neutral* by reverse rotation method (on reversible motors). Operate the motor at constant full load current and voltage in armature, with field current and voltage adjusted for maximum speed. Have a good brush fit; measure speed in rpm. for both directions of rotation. Speed should be the same in either direction. If faster in one direction than the other, brushes should be shifted toward the faster direction until the speed in either direction of rotation is the same. To obtain best brush position for good commutation and desired voltage and speed characteristics of both generators and motors, observe commutation of machines while under load after this test is made.

If the test machine is a generator, the output voltage with a given field will be greater when brushes are shifted ahead of the neutral plane in the direction of rotation; less when shifted away from the neutral plane in the opposite direction.

2. *Running Light Losses Test* is made to determine the combined no-load rotational frictional and core losses in the generator or motor. The machine is operated on a suitable voltage at rated speed with no load. The voltage is equal to the internal potential induced in the machine at full load. This suitable voltage is higher in generators and lower in motors than the rated voltage by an amount equal to the full load resistance drop of the armature, commutating and series field windings, plus the brush contact drops (ordinarily taken as two volts for the sum of both positive and negative polarities). Operation continues until the bearing temperature becomes constant.

With the field properly excited, the input to the armature and main field circuit is separately determined with all brushes down, at a time when the speed of the armature rotation is absolutely constant, as indicated by a constant value of current input.

3. *Brush Contact Resistance* is the opposition to the flow of current at the plane of contact between brush and commutator. This is always present and must be taken into consideration when computing the losses.

The input current to the armature is read while only the minimum number of brushes (required to carry the armature running light current) is down. This permits a separate determination of brush friction and armature rotational losses.

4. *Magnetic Saturation Test* is made to determine the field excitation required to provide a given armature flux and voltage at rated speed and no load. This data is usually determined at several properly spaced points from zero to 125 or 150 percent of rated voltage. The machine may be separately driven (as a generator) or self-driven (as a motor).

A. Separately Driven Machine — Saturation is determined by driving the machine at rated speed, with field current being supplied from a separate source in order to stabilize the voltage and assure correct readings. The brushes should be well fitted and set on the no-load neutral. As an additional refinement (although not required for commercial tests), the main brushes are sometimes removed and replaced by two brushes (one for each polarity), which have been beveled down to a fine line contact just the width of the commutator segments. These are mounted parallel to the segments and located exactly on the no-load neutral.

Simultaneous readings of field current and armature voltage are taken "with rising field current," that is, the field current must be continuously increased without any decrease. Four readings are taken as near as possible at 90, 100, 110, and 125 percent of normal load.

After obtaining data at maximum voltage (125 or 150 percent, if desired), another set of readings is taken with falling field current, step by step, with simultaneous readings from the maximum down to 90 percent voltage.

B. Self-Driven Machine — Saturation is determined by operating unit as a motor with corresponding values of field current and armature voltage determined at rated speed. A separate

source of d-c power which can be varied from 25 to 150 percent of the rated voltage is used.

It is possible that the machine will become unstable at low voltage so precautions against overspeed must be taken.

5. *Open Circuit Core Loss, Windage, Friction.* During the test made to determine the magnetic losses in the armature core, the sum of windage and bearing losses can be determined. Two commonly recognized methods can be used: (A) separate driving motor; (B) retardation or deceleration.

A. The Separate Driving Motor Method is preferred for its simplicity and accuracy. Equipment required for this test includes:

a. A d-c motor with rated capacity not over 10 percent of machine to be tested.

b. Two insulated brushes (one in each polarity) for determining motor armature volts exclusive of main brush contact drop.

c. Source of variable d-c voltage suitable for the driving motors.

d. Suitable meters for indication of motor field current, armature current, and voltage, and field current and armature voltage of the tested machine.

e. Tachometer.

Drive the machine at rated speed and at zero voltage, with commutator brushes symetrically fitted and with normal brush pressure. Continue until constant input to the driving motor armature has been observed for 30 minutes. Then take simultaneous readings of driving motor armature input (voltage and current), machine field current and armature voltage measured at eight or ten uniformly distributed voltage steps from residual voltage (zero field) to 125 percent voltage. Take a final reading at zero field to check the initial observation.

Make all observations with "rising" field current.

Net Power Input

The net power input to the machine is the driving motor armature input less the motor armature I^2R and running light losses at the corresponding motor internal induced voltage, speed, and field current.

The core loss at any voltage is the excess of the net input to the machine at that voltage over the input at zero or residual voltage. A determination of net power input to the machine with d-c brushes raised and zero field current enables d-c brush friction to be determined.

B. The Retardation Method is based on determining the angular deceleration of the armature due to the losses. This, together with the WR^2 of the armature, determines the decelerating torque due to losses.

By WR^2 is meant the fly-wheel effect of the armature wherein the weight of the armature or rotating mass in pounds is denoted by "W", the radius to the center of gyration in feet is denoted by "R". The fly-wheel effect in any motor is equal to W x R x R and is known in America as the WR^2 effect.

Used where the separate drive method cannot conveniently be employed, the retardation method requires:

a. A source of d-c power to bring the machine up to 110 percent speed as a motor.

b. A d-c voltmeter suitable for machine rated voltage.

c. A d-c ammeter suitable for rated field current.

d. A tachometer or rpm. counter for measuring rotational speed.

e. A chronometer or stop-watch to indicate time in seconds.

First step in this test is to determine the normal field current (the value of the field current with rated voltage impressed on the machine terminals which produces rated speed).

Rate of Deceleration

Select several values of field current, from 30 to 125 percent normal, then hold the selected values of field currents constant. At the same time bring the machine up to 110 percent speed by varying the impressed terminal voltage. Next, interrupt the power and check the speed and armature voltage at time intervals of 5 to 10 seconds until the speed has fallen to about 75 percent of normal. Repeat for each selected value of field current, also at zero field current. Use this data to plot a series of speed-time curves to determine, at normal speed, the slope or rate of deceleration in rpm. per second.

The core loss, winding loss, and bearing loss (known as kilowatts loss), is calculated by the following formula:

$$KW = \left(\frac{4622}{1010}\right)\left(WR^2S\right)\left(\frac{ds}{dt}\right)$$

Where: W = weight of complete armature—in pounds
R = radius of gyration—in feet
S = rate of speed in rpm.
$\frac{ds}{dt}$ = rate of deceleration—in rpm. per second

The WR^2 value may be obtained from the manufacturer as calculated from known weights and dimensions of the component parts; or it may be determined experimentally as follows:

Support the armature in bearings having two to three times the diameter of the journals. If the journals are of different sizes the smaller ones must be pushed up to the same size as the larger. Displace the armature and allow it to roll or rock freely in the bearing and determine the period of time in seconds (T) of a complete oscillation. Then:

$$R = R_1 \times \frac{0.815T^2}{R_1 - R_2} - 1.$$

Where: R_1 = radius of bearing in feet.
R_2 = radius of journal in feet.
T = time of one period in seconds.
W = weight in pounds (must be given or determined by weighing).

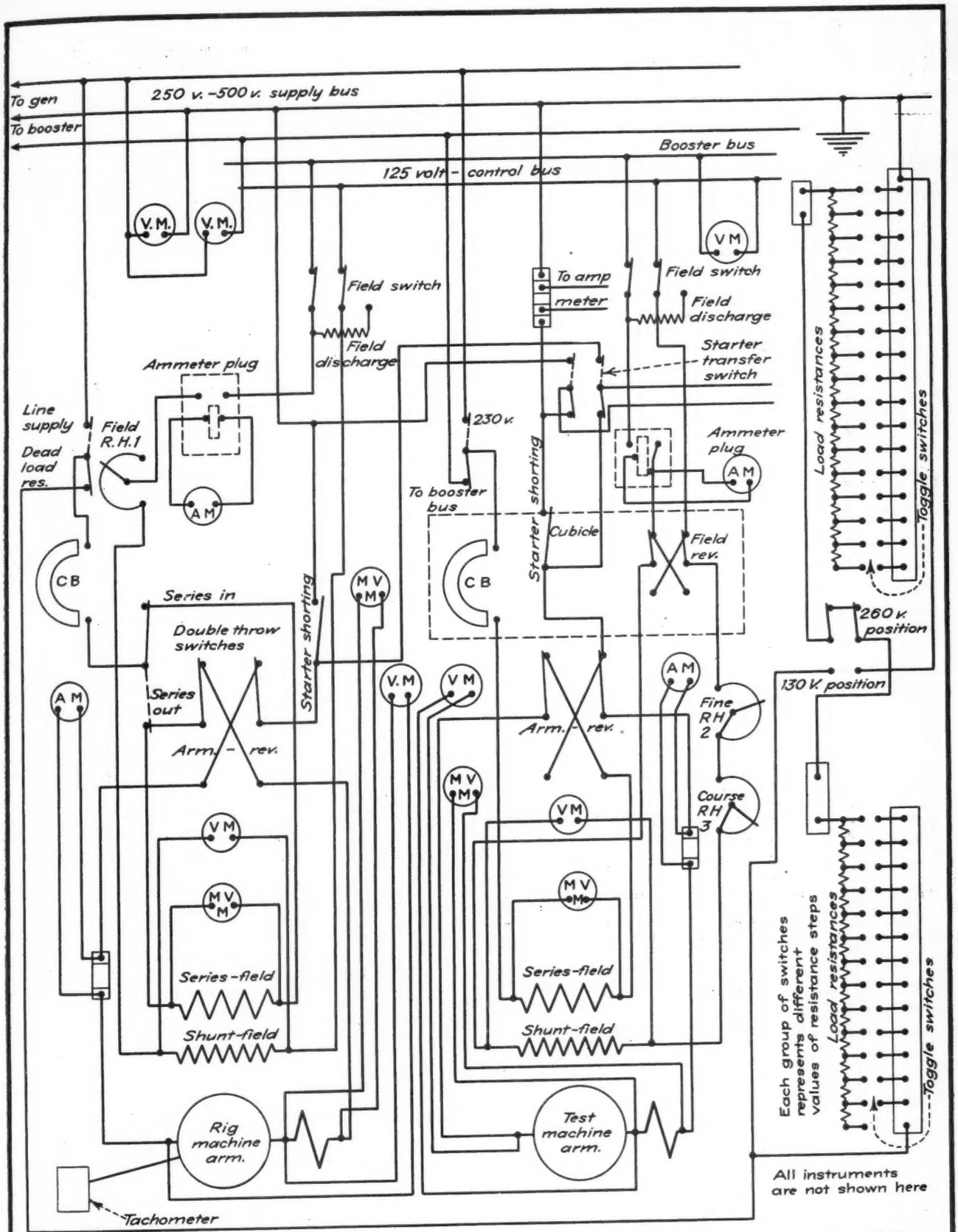
6. *Voltage Regulation of Shunt-Wound Generators*—This test to determine voltage and load characteristics is made at normal full-load operating temperature. Raise the voltage to its rated value with rated load current maintained, and observe the corresponding field current. Then, without a change in the field rheostat setting, reduce the load current to zero in 25 percent steps, and note the terminal voltage at the end of each step; also the corresponding field current. The final rise in voltage expressed in percent of the rated full-load voltage is the "regulation" of the machine.

7. *Voltage Regulation of Compound-Wound Generators*—is determined when generator is operating at rated load and speed. Then, with a decaying field current adjust the no-load terminal voltage to its rated no-load value. The decaying field current is used because compound-wound generators show higher terminal voltage at intermediate loads than at no load.

Apply load at 25 percent steps up to full-load output, and observe the terminal voltage and the corresponding field current at each step.

8. *Speed Regulation of a Motor* indicates the percent change in speed when rated load is removed. After the motor has attained normal operating temperatures, run the motor at its rated terminal voltage and load. If a field rheostat has been provided, adjust the field current for rated full-load speed. Then, remove the load in 25 percent steps and observe the speed at each step with the field adjustment remaining unchanged. The speed must settle down to a steady value before the reading is taken.

The speed regulation of a reversible motor should be approximately the same for either direction or rotation.



Solid lines at switches show the set up when test machine is a motor and driving rig machine while acting as a generator being loaded by the dead load resistors. Dotted lines indicate set up for test machine when acting as a generator and being loaded by dead load resistors. Either rig or test machine can be used as a generator to feed back on supply bus with this set up

FIG. 1—Circuit diagram for set-up to perform efficiency tests on a d-c compound interpole motor at Allis-Chalmers' Norwood test floor.

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

F-6

Table for computing various constants such as voltage drop, conductor size, circuit length, and current, when any three of these constants are known.

THREE-PHASE CIRCUITS IN IRON CONDUIT UP TO 600 VOLTS

Maximum circuit length based on maximum rated current at 80% power factor for a 1-volt drop.

Cond. Size AWG or MCM	COPPER CONDUCTORS Type "R" 60°C. Cond. Temp.			COPPER CONDUCTORS Type "RH" 75°C. Cond. Temp.			ALUMINUM CONDUCTORS 75°C. Cond. Temp.		
	Max. Rated Current in Amperes	Max. Circuit Length in ft. at max. Current for 1-volt Drop 3-Phase	Factor F=LI/V	Max. Rated Current in Amperes	Max. Circuit Length in ft. at max. Current for 1-volt Drop 3-Phase	Factor F=LI/V	Max. Rated Current in Amperes	Max. Circuit Length in ft. at max. Current for 1-volt Drop 3-Phase	Factor F=LI/V
6	55	24.2	1331	65	19.4	1261	55	14.7	808
4	70	29.2	2095	85	22.9	1947	70	18.1	1267
2	95	32.3	3068	115	25.5	2932	95	20.7	1966
1	110	33.8	3718	130	27.4	3560	110	22.1	2431
1/0	125	35.9	4487	150	28.8	4320	125	23.8	2975
2/0	145	37.1	5379	175	29.7	5197	145	25.1	3639
3/0	165	38.5	6350	200	30.6	6120	165	26.6	4380
4/0	195	38.3	7470	230	31.4	7222	195	27.0	5260
250	215	38.0	8170	255	31.2	7956	215	27.6	5930
300	240	38.0	9120	285	31.1	8863	240	28.1	6740
350	260	38.5	10,000	310	31.1	9641	260	28.8	7480
400	280	37.8	10,600	335	30.9	10,350	280	28.9	8090
500	320	37.1	11,900	380	30.0	11,400	320	29.0	9280
600	355	35.9	12,750	420	29.2	12,260	355	28.8	10,200
700	385	34.8	13,400	460	28.6	13,160	385	28.6	11,000
750	400	34.4	13,750	475	28.2	13,395	400	28.3	11,300
800	410	34.0	13,940	490	27.8	13,620	410	28.5	11,680
900	435	33.2	14,500	520	27.4	14,250	435	28.8	12,530
1000	455	33.0	15,010	545	27.0	14,710	455	28.9	13,150

Rated currents are based on the 1947 National Electrical Code, with currents for aluminum conductors being taken as 84% of the current for type "RH" copper conductors and rounded off to 5 ampere values as was done by the Code authorities.

On single phase circuits the maximum circuit length in feet at maximum current for 1-volt drop is 86.5% of above values. The factor F for single phase circuits is also 86.5% of above values.

Example No. 1:

What size of conductor should be used to carry 130 amperes for 200 feet with a voltage drop of not more than 3% on a 3-phase conduit wired system at 220 volts A.C. using aluminum conductors?

$$F = \frac{LI}{V}$$

V Voltage drop = 6.6 = Volts
I Current = 130 = Amps.
L Length = 200 = ft.

$$F = \frac{LI}{V} = \frac{200 \times 130}{6.6} = 3940$$

Refer to table and pick out the aluminum conductor size having a factor equal to or larger than this value. In this case a 3/C #3/0 cable should be used to fulfill the circuit conditions, in spite of the fact that a #2/0 is large enough for the current. Voltage drop is the limiting factor.

Example No. 2:

What voltage drop will occur if three #3/0 single conductor aluminum wires in an iron conduit are used to carry 150 amperes for 150 feet on a 3-phase circuit?

$$F = \frac{LI}{V}$$

L = 150 ft.
I = 150 Amps.
F = 4380 (from table for 3/0 aluminum conductor)

$$4380 = \frac{150 \times 150}{V}$$

V = 5.1 Volts

Example No. 3:

What current will 3 single conductor 750,000 CM aluminum wires carry when installed in conduit so that voltage drop does not exceed 5% on a 440-volt 3-phase circuit 500 feet long?

$$F = \frac{LI}{V}$$

L = 500 Ft.
V = 440 × .05 = 22 Volts
F = 11300 (from table for 750,000 CM conductor)

$$11300 = \frac{500 \times I}{22}$$

I = 497 Amperes

The current is more than the maximum permissible (400 amperes), and capacity is the limiting factor.

Example No. 4:

For what distance can two single conductor 500,000 CM aluminum conductors in iron conduit carry 200 amperes at 110 volts, single phase, so that the voltage drop does not exceed 5%?

$$F = \frac{LI}{V}$$

$$F = 9280 \times 86.5 = 8027$$

$$V = \frac{110 \times 5}{100} = 5.5 \text{ Volts}$$

I = 200 Amperes

$$8027 = \frac{L \times 200}{5.5}$$

L = 220.7 Ft.

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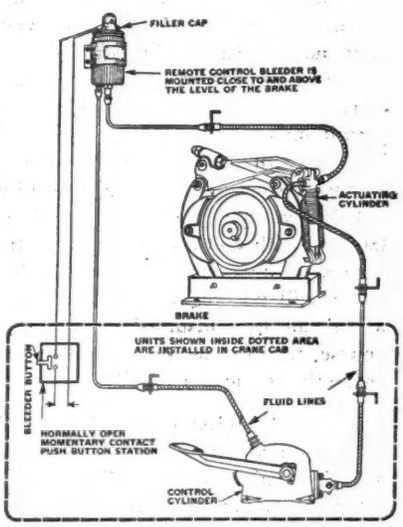
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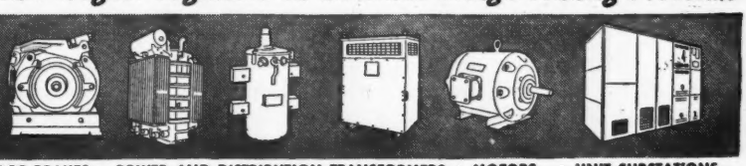

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

148-2

ELECTRICAL AND AUTOMOTIVE PRODUCTS

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

Reader's Quiz

Power Transformers

QUESTION 266—We have power transformers connected in open delta, with the power company's meters on the primary side. Transformers in open delta operate at only 86.6—power factor. Does this mean that we are losing 13.4 percent of the power paid for?—H.C.L.

A. TO QUESTION 266—No. you are not losing 13.4 percent of the power paid for. The watt-hour meter is arranged to read only the in-phase portion of the product of the volts and amperes. This occurs regardless of whether you are using open-delta or closed-delta connected transformers. Essentially, the open-delta connected transformer bank must carry 100 percent current in the transformers and only supply 86.6 percent current to the load. In other words, a three-phase load of 86.6 amperes would cause 100 amperes to flow in the transformers of the open-delta bank. Your watt-hour meter is registering a value based on the load current and voltage drawn. What this connection really does is to permit only 86.6 kva. load on two 50 kva. transformers, as an example. A vector analysis of this might be given but the average reader is probably not familiar with vectors, so this is omitted. You need not worry. Your watt-hour meter will not register more than the actual energy consumed, providing, of course, that the meter is accurate and correctly connected.—L.R.B.

A. TO QUESTION 266—A detailed answer to this question would involve a long discussion of what power factor means. Suffice it to say that a bank of transformers in open-delta and operating at 86.6 percent power factor will have a lower efficiency than if they were in closed-delta. That is, the increased current caused by the low power factor will cause a higher iron and copper loss in the transformers. However, you then only have losses of two transformers to consider instead of losses in three transformers. As a result the operating cost will be about the same for two transformers in open-delta as for three in closed-delta.

H. C. L. has no cause for worry; it is the power company who suffers by this arrangement. Since the metering is done on the primary side, H. C. L. will have approximately the same energy consumption but the power company must supply reactive power necessitated by the 86.6 percent power factor of the transformer bank. This 86.6 percent power factor does not mean that H. C. L. is only receiving 86.6 percent of the power paid for; it means that he is only paying for part of the current supplied by the power company. He is paying for the energy consumed at his plant. In an open-delta bank an additional current is necessary to magnetize the transformer windings. This current plus the energy current combine to form the current supplied by the power company. The meters register only the energy current or 86.6 percent of the total current that is supplied by the power company.

H. C. L. can rest assured that he is not paying for energy that he does not receive. It is the power company that is penalized by this arrangement, although it would be more satisfactory to meter on the secondary side if it could be arranged. The copper and iron losses in the transformer could be calculated on a closed-delta basis and paid for accordingly.—W.P.R.

A. TO QUESTION 266—A properly connected meter on the high tension side of an open delta transformer bank will correctly measure the losses in the transformers plus the energy taken by the load. In relation to the load, the losses in an open delta bank will not be appreciably different from those of an equal capacity closed delta connection. The force turning the meter disk depends partly upon the phase relationships between the potential and current coils. This automatically compensates for power factor.

With balanced 3-phase loads, the line current is 1.73 times the delta phase current. At unity power factor, they are 30° out of phase. The power factor of the open delta connected transformers themselves is 86.6 percent (with the unity power factor load) because the entire line current must pass through the transformer windings. The current in each transformer will be equal only under conditions of unity power factor in the load. The available capacity of an open delta is only 58 percent of a closed delta bank, all transformers having the same rating ($\frac{2}{3}$ of a transformer bank times 86.6 percent power factor, equals 58 percent.)

The main advantage of an open delta transformer bank is initial economy, especially when the load is expected to increase. The disadvantage is in the tendency for unbalanced secondary voltages. Actually, the phase difference between the current and voltage in a transformer winding is never the same as the phase difference found in the load. The open delta connection presents an exaggerated relation without affecting the metering.—L.E.B.

A. TO QUESTION 266—It is possible that the cost will be more for an open-delta connection than for a closed-delta connection, but the difference would not be 13.4 percent. The question does not give sufficient information for it to be easily answered because of the variations in power contracts. If the rate schedule, demand, power factor of the load, and kw-hr. consumption had been given, the cost for both an open and closed delta connection could have been figured; however, with the information at hand, each probable variation in the contract will have to be explained.

The kilowatt-hours registered by a meter depends upon the kilowatt load and the number of hours it is used. The kilowatt load, however, is governed by the kva. (kilovolt-ampere) load and the power factor; kilo-watts=kilovolt amperes multiplied by the power factor. The fact that the meter is on the primary side makes no difference except that the power loss in the trans-

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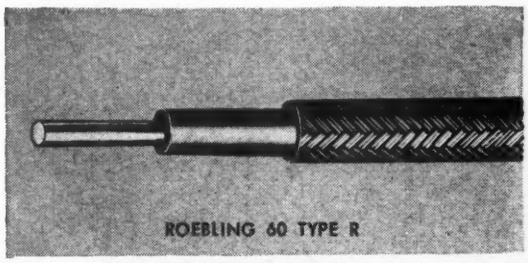
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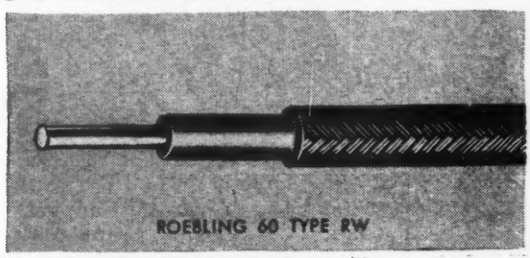
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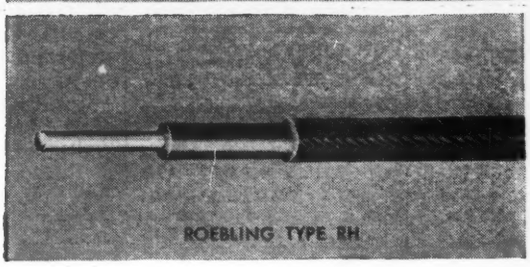
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formers is included. This is approximately 2 percent.

Some power companies make a demand charge. If the charge is based on the kilowatt load, or the horsepower load, the cost will be the same for both an open-delta and a closed-delta bank; however, if the demand charge is based on the kva. load, the cost will be more for the open-delta connection than for the closed-delta connection. For example, if we connect two 15-kva. transformers in open-delta, or three 10-kva. transformers in closed-delta, the capacity of the banks will be 30 kva. If we connect a unity power factor load of 25.98 kilowatts to each bank for 100 hours, the kilowatt-hour consumption will, in each case, be 2,598. The kilowatt demand in each case will be 25.98; the horsepower demand in each case will be 34.81 (25.98 x 1.34); however, the kva. demand will be different. When a unity power factor load is connected to an open-delta bank, the current is in phase with the voltage across the load, but it is 30 degrees out of phase with the voltage across the transformer, both on the secondary and primary sides. The kva. load would be 30 (25.98 when divided by 0.866.) and the two 15-kva. transformers would be fully loaded. When a unity power factor load is connected to a closed delta bank, the current is in phase with the voltage across the load and also the voltage across the transformer. The kva. load of the closed delta bank would therefore equal the kw. load and would be 25.98 as compared with 30 for the open delta bank. The kva. demand of the closed-delta bank would be 86.6 percent of that of the open-delta bank, or the kva. demand of the open-delta bank would be approximately 15.5 percent more than that of the closed-delta bank.

If there is a demand charge and it is based on the kw. or hp. load, some power contracts contain a power factor clause which penalizes the user for a low power factor. The penalty is usually applied when the power factor is less than 0.8, and the cost increases as the power factor decreases below 0.8. If the power factor of the load is less than unity and the load is inductive, the current through the transformers in open-delta lags the voltage.—G.L.P.

Conductors

QUESTION 267—We have a 500 hp. 505 rpm., 2200 volt, 3 phase, 60 cycle wound-rotor motor on a rubber mill-line drive. The starter and secondary resistors are located in a control room, approximately 400 feet distant

1 **1633**—First brewery in America was built in New York City near what is now Wall Street. Our Founding Fathers fostered this "beverage of moderation" by low taxes on domestic beer.

2 **1842**—Lager beer arrived and for years demand far exceeded supply. Improved methods of bottling, capping and handling that were to make brewing "big business" were still to come.

3 **1915**—Howell industrial-type "Red Band" motors appeared. The advent of low-cost electric power made modern bottling possible, upped beer production, cut costs. Brewing boomed!

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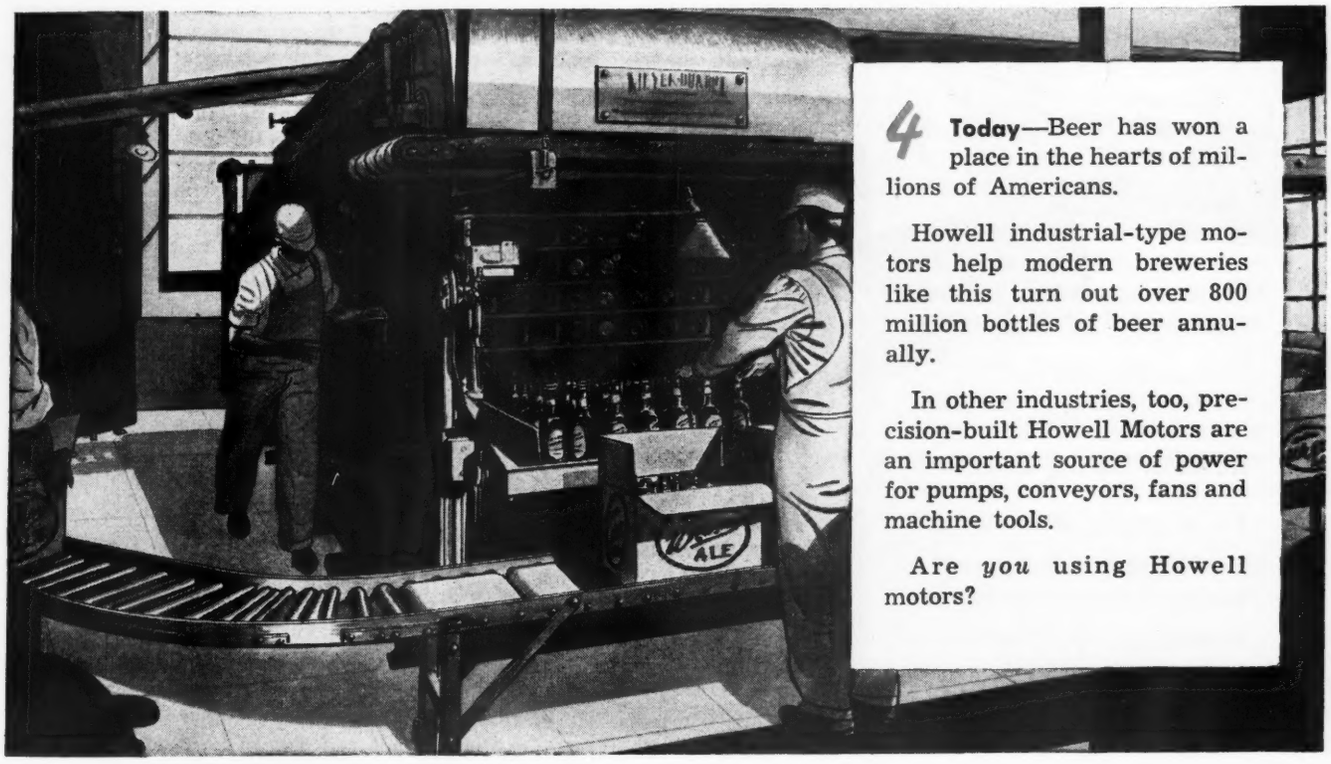

4 **Today**—Beer has won a place in the hearts of millions of Americans.

Howell industrial-type motors help modern breweries like this turn out over 800 million bottles of beer annually.

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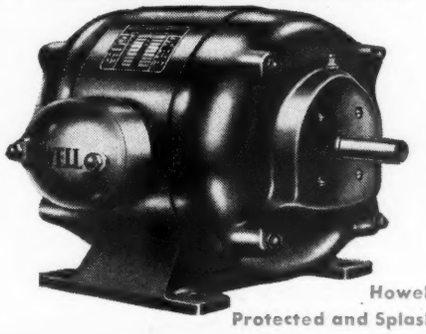

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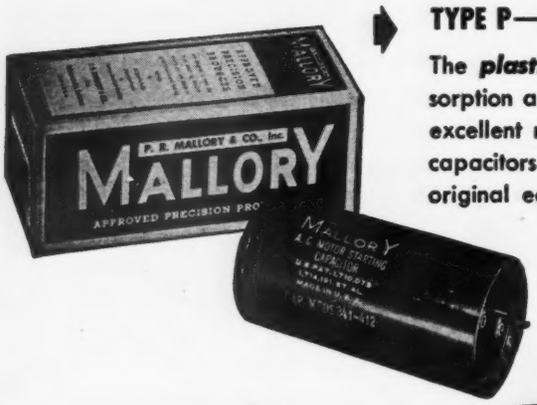

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from the motor, including a vertical run of about 30 feet. The secondary conductors between motor and starter are three 500 MCM in 3-inch conduit.

We have noted the secondary conductors slapping against the inside of the conduit in the vertical run with varying intensity, sometimes so hard as to cause concern over the possibility of damage to the insulation. What is the explanation for this? Is it customary to take precautions against this in installations of this type, or is it covered in the Code?—W.E.T.

A. TO QUESTION 267—The strains that the conductors are subjected to are due to magnetic fields surrounding the conductors when carrying heavy currents. Transposing the conductors will relieve this condition somewhat, and will also reduce other magnetic effects, such as self and mutual induction.

When space will not permit the required transpositions; the conductors are usually held in place with an approved sealing compound blown into the conduit. Asbestos powder is sometimes used since this will not gum or harden and the conductors can be easily withdrawn when the circuit is discontinued or rewired.—T.B.B.

A. TO QUESTION 267—The magnetic stresses which affect conductors carrying heavy currents and lying close together are severe and will cause them to move and vibrate if they have such freedom.

At standstill the rotor frequency is equal to the line frequency. Under that condition the conductors, due to their inertia, will just pull together and vibrate with the rapidly changing magnetic field which surrounds them. Each wire in turn will be attracted and repulsed by the others. The rotor frequency, however, is proportional to the slip. Assuming the synchronous speed to be 514.2 rpm., and full load speed is 505 rpm., the rotor frequency is equal to:

$$\frac{514.2 - 505}{514.2} \times 60 = 0.96 \text{ cycles per second.}$$

This relatively slow change in the magnetic flux which encircles the conductors permits a much greater movement of them as they change position in response to the attraction and repulsion of their respective magnetic fields. The conductors in the vertical section of conduit are especially vulnerable to these forces.

It is obvious that the only practical remedy that can be applied is to remove the cables, tape them securely together, and replace them, or use a three conductor cable.—R.J.M.

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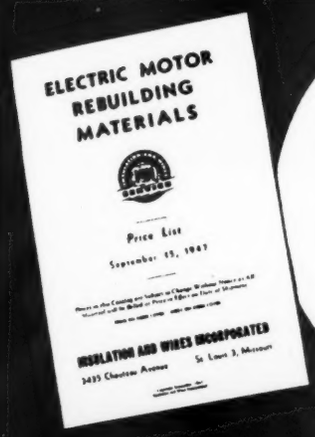

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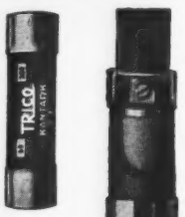

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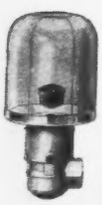

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A. TO QUESTION 267—Your present cable and conduit capacity are installed according to code. Your cable drop is allowable within the code range.

You must check your cable with the present condition, when you alter this vertical riser by installing an additional junction box with the distance of your 30 ft. drop. Don't forget when you install this junction box you must use a cable support to prevent your cables from slapping the inner conduit wall.

If you do not install this junction box and cable supports—if it is convenient, take the 3 secondary leads and twist these leads so that you can at least get 3 turns within the total distance of the drop. I know you can eliminate the present condition.—O.C.

Checking Brush Rigging

Q. *UESTION 268—Can one check the brush rigging setting on a d-c generator with interpoles on full load? Or does the millivoltmeter method check for zero volts on the commutator have to be done only on no load with full voltage to get the proper brush setting, that is, when a generator has interpoles?—E.J.K.*

A. TO QUESTION 268—The answer is "yes". The condition of the machine as regards brush position and interpole strength may be determined at any desired load by use of either the brush curve method or the field form method.

In the brush curve method, use a high resistance voltmeter with a range of about 6 volts. Connect one terminal to the brush stud and the other to a graphite rod which is moved across the thickness of the brush in contact with the commutator. The desired curve obtained should be in the neighborhood of one to two volts at the entering edge of the brush and should drop to zero to one volt at the leaving edge.

The field form curve is determined by use of a somewhat higher reading voltmeter connected to two graphite rods spaced one commutator bar width apart. Readings are taken by moving the two contacts along the commutator adjacent to a brush arm. A good curve should show low voltage at the brush location with a positive on one side and a negative on the other.—M.S.M.

A. TO QUESTION 268—It is feasible to check the brush position of an interpole generator under

load. By making up a test prod with two points (insulated from each other and spaced about one segment apart) and connecting these to a sensitive millivoltmeter for use as a probe, the commutator area around the brushes may be probed and when a minimum reading is obtained the neutral position should be found.

If the interpoles are of correct value neutral should be same for all loads. Strength may be altered by shimming or by use of shunts to vary current through coils. An ordinary scrap of resistance wire may be used, experimeeting until proper size is found. Also check frame of machine and brush rigging for lining up marks.

If it is possible to shut down the machine for a few minutes and motorize it, a rough but fairly close method is to check the speed of the armature in both directions, moving brush rigging until speed is equal in either forward or reverse direction when measured with a direct reading tachometer. —R.G.A.

A. TO QUESTION 268—When using the millivoltmeter method to find the brush setting, neutral, on a d-c generator or motor, the machine must be operating under normal load.

In checking the brush setting on any d-c machine, examine all brushes to see that they are properly seated on the commutator; make certain the air gap, between all pole pieces and the armature, is exactly equal; and check to see that the brush sets are exactly equidistant from each other.

If you find the above factors o.k., and you still don't obtain sparkless commutation, your machine is either over-compensated, or under-compensated. If over-compensated, the interpole flux can be reduced by shunting the interpoles with a variable resistance shunt. This will weaken the strength of the interpole field.

If the machine is under-compensated, the interpole field may be strengthened by placing shims under the interpole pieces.—D.E.M.

A. TO QUESTION 268—If the generator in question has the proper size, and the proper magnetic polarity interpoles the commutating plane should remain comparatively stationary under varying loads and no load. In other words, if the point of zero potential is located on the commutator that should be the place to set the brushes. To check this zero point it is advisable to try at different loads and see if the location remains the same. If the zero point moves slightly the brushes should be set for the average load. But if your commutating plane moves sharply this indicates a wrongly connected interpole.—H.C.S.

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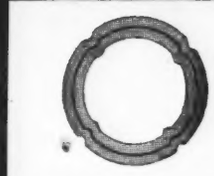

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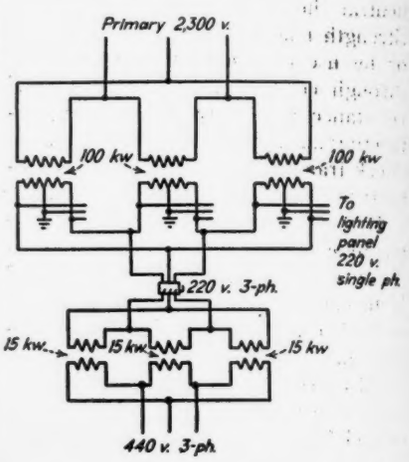
QUESTION R12—Is the hook-up of the transformer, as shown in the sketch, wrong, and if so, why? While the conditions may be unusual, an interesting problem is involved on which I have received opposite opinions from several engineers.—J.J.W.



QUESTION S12—In a plant where the power circuit is ungrounded, shocks are obtained on the secondaries of welding transformers. These are apparently caused by the capacity to ground of the circuit. Is there a way to eliminate these shocks?—C.P.S.

QUESTION T12—Is there a way I can determine the direction of rotation of a squirrel cage motor without having to "try"? Often such motors are connected to a load which may not be turned in the wrong direction and I would like to know in advance how to connect the mains to get a certain direction of rotation.—S.V.H.

QUESTION V12—I notice that coils for solenoids on a-c circuits are wound of two different sizes of wire and connected in series. What is the reason for this? Also, does it make any difference as to which way the coil is mounted in relation to the plunger and why?—S.R.U.

QUESTION W12—How can I recognize a poorly soldered 60 amp. fuse end? On several fuses the solder melted instead of the link. The fiber was not charred.—H.S.

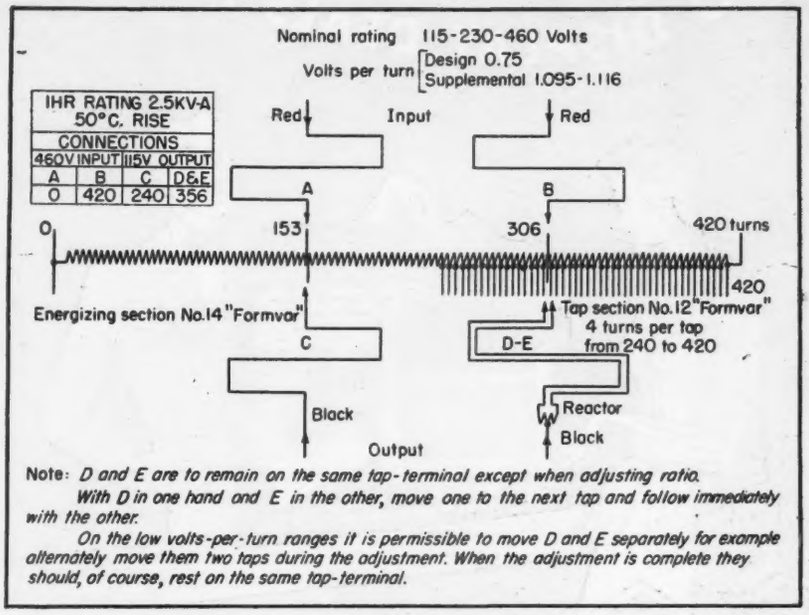
PLEASE SEND IN YOUR ANSWERS BY MARCH 15

Motor Shops

Auto-Transformer for Voltage Control

Electricians are often confronted with problems of wrong voltage when using power tools or when testing equipment. Emmett Keough, of the Iowa Electric Light and Power Company, submits a suggestion for correcting this condition. Mr. Keough states that continuously adjustable auto transformers, with each turn available through a sliding brush contact, are excellent for low current testing but high current output with this brush type, even for intermittent service, is possible only with oversized equipment.

The transformer here discussed was designed for these applications. In this assembly, a lot of power is contained in a small package. True, voltage control could be smoother, but this objection is offset by the broad range. Another advantage is that brush heating, resulting in damage to the entire unit, is eliminated. Transformation ranges are about double. With this assembly, any supply voltage from zero to 460 volts on a 60 cycle system can be transformed to supply power for the standard ranges of 115-230-460 volt utilization. These basic voltages are variable in small steps from zero to 460 volts. Applications are many and construction steps are explained by the accompanying diagram and photographs.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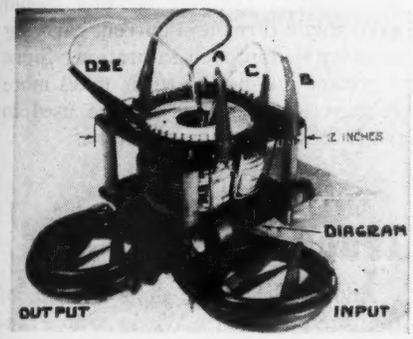
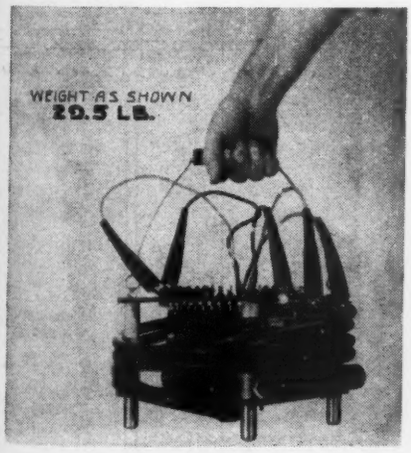
Volts per turn Design 0.75
Supplemental 1.095-1.116
1HR RATING 2.5KV-A
50°C. RISE
CONNECTIONS
460V INPUT 115V OUTPUT
A B C D&E
0 420 240 356
Red
Input
Red
A
B
0
153
306
420 turns
420
Energizing section No.14 "Formvar"
Tap section No.12 "Formvar"
4 turns per tap
from 240 to 420
C
D-E
Black
Reactor
Black
Output
Note: D and E are to remain on the same tap-terminal except when adjusting ratio.
With D in one hand and E in the other, move one to the next tap and follow immediately with the other.
On the low volts-per-turn ranges it is permissible to move D and E separately for example alternately move them two taps during the adjustment. When the adjustment is complete they should, of course, rest on the same tap-terminal.

Wiring diagram indicates location of taps and size of wire. Major transformation ranges are indicated on schedule.



Input and output leads are indicated. Indication of size of assembly is also given.



Unit is readily lifted by attached handle and can be moved in accordance with requirements.

Note that both Input and Output leads can be connected to any combination of taps on the winding and that the tap section is uniform and a third greater than the energizing section in current-carrying capacity. Taps are numbered according to the number of turns from the starting end rather than according to voltage.

The only real need for caution is to be sure sufficient turns are in the input leads before energizing. A wound-round core can be obtained second-hand but magnet wire should be new. The core is hand wound, no lathe being required. The required amount of No. 14 wire can be carried on a shuttle or bobbin small enough to pass through the core window. This wire is wound on the insulated core with a tap at 153 turns. After 240 turns have been completed, No. 12 wire is spliced to the No. 14. The No. 12 wire is then wound back over the No. 14 layer, previously insulated, and taps are made every four turns until a total of 420 turns have been applied. This will practically cover the first layer. Since the winding area on the outside is about twice that of the inside, it will be necessary to make the winding in the window two layers. This is accomplished by placing turns adjacent for two turns with the next turn, in the window only, on top. This method is used on both inner and outer windings.

If tap terminals are arranged in a large circle, as shown in the photo, it will not be necessary to bring them all out on the same side. Sufficient wire should be spliced to reach these terminals, however. The core-coil assembly is padded with ½-inch felt between the upper and lower insulating boards.

The center-tapped reactor is a small iron core with 20 turns of No. 14 wire. This need not be a problem to design since half cycling is not necessary. If high circulating current exists at the moment D and E are on different taps, the result is not objectionable since the voltage on 4 turns is low and this current will stop circulating as soon as both D and E are again on the same tap. The voltage arc is negligible. The reactor, not visible in the photo, is mounted on the bottom board between the transformer and leg bolt spacer.

NEW!

TWO DISPLAY DEALS FOR '48!

No. 1812 for "Built-in" (wall type) models

ILG VENTILATION

Colorful new displays complete with electric ventilators and selling helps!

Get into the booming fan business with these two potent sales-making display deals. Multi-color, compact displays can be used in your window, on aisle tables, counters, or flat-topped appliances. Each display factory-packed with two electric ventilators and complete set of selling helps—when deal arrives, you are ready for business! Hurry—get complete information by calling your wholesaler, sending coupon, or phoning ILG Branch Office (consult classified directory).

No. 1725 for plug-in "Portable" (window frame) models.

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2879 N. Crawford Ave., Offices in more than 40 Principal Cities

☐ Rush information on new display deals in "ILGMAN"

Firm Name .....

Individual ..... Title .....

Address ..... Zone .....

City ..... State .....

SCHEDULE OF MAJOR TRANSFORMATION RANGES					
IF SOURCE IS	CONNECT INPUT A	CONNECT INPUT B	CONNECT OUTPUT C	RANGE OF OUTPUT VOLTAGE	VOLTS PER TURN
115V	240	420	240	0-115	.639
	153	306	153	65-200	.75
	0	420	0	66-115	.274
	0	306	0	90-157	.375
	0	153	0	180-315	.75
	* 153	256	0	267-468	1.116
230V	0	306	153	65-200	.75
	0	420	0	132-230	.548
	0	306	0	180-315	.75
	0	240	0	230-403	.959
460V	* 0	420	240	0-197	1.095
	* 0	420	153	95-292	1.095
	* 0	420	0	262-460	1.095

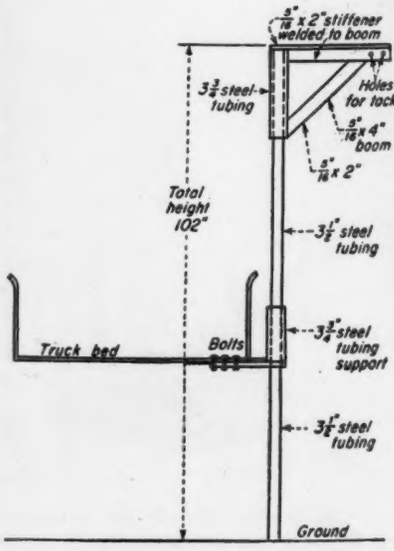
*USE CAUTION!

For this assembly, an audio output transformer core was used but an old bell ringing transformer core would have been even better. If the obtained core varies in dimensions from those given on the diagram, a certain amount of redesign will be necessary.

The most practical method to follow in design is that of actual test. About 50 turns should be first wound around the core with voltage and current readings taken in small steps as saturation is approached. This is done with a variable voltage applied to these turns. A curve can be plotted of these readings and a volts-per-turn value selected close to the knee of the curve. At this point, magnetizing current should be satisfactory. The test winding should have ample turns and current carrying capacity to approach saturation. Since a greater number of turns takes more voltage, smaller wire can be used to reach the required ampere-turns.

Truck Hoist

Adolph Schwindt, shop foreman of the Buzzell Electric Works, San Francisco, designed this truck hoist and built two, one for use by the motor



Details of truck hoist

As shown, Simplex-ANHYDREX Underground Cables have the conductors coated with an alloy and then an adequate wall of the famous Simplex-ANHYDREX low water absorption insulation which is remarkably stable, both electrically and physically, in the presence of moisture. Colored braids or tapes are applied over each individual conductor. The conductors are twisted and then jute filled to make the cable round. Over this is a thick wall of specially compounded neoprene.

Simplex-ANHYDREX Underground Cables are easily pulled into ducts or they can be buried directly in the ground without any further protection. Where they come up above ground, the neoprene jacket effectively prevents deterioration due to sunlight and weather. The jacket also resists the action of ground acids and alkalies, as well as oil, heat and flame.

Simplex-ANHYDREX Cables can be used underground, with or without ducts. They can be used in the air, supported from messenger wire. They have many applications as power, traffic signal, railway signal, control, supervisory control, telephone and telegraph installations.

A copy of the Simplex-ANHYDREX Cable book will be sent to you upon request.

Simplex

WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

McGILL VAPORPROOF LAMP GUARDS

TRADE MARK

No 3005*

TAKE PROTECTED LIGHT ANYWHERE *Safely*

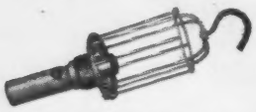
Be sure of complete safety from fire and other disaster caused by a spark, heat or breakage of light bulbs with a McGILL Vaporproof Portable Guard.

Models designed for particular uses include such important features as brass or fibre cages, unbreakable moulded bakelite handles, heat and impact resistant globes. Completely air tight and waterproof.

Over a hundred other McGILL Lamp and Wall Guards available. Each built for a specific requirement of industry. They insure safe, convenient light anywhere it is needed — thereby increasing production efficiency.

*No. 3005 Vaporproof Guard has a heavy brass wire cage with sealed Insurok handle and air and moisture proof globe that is heat and impact resistant. Lamp size — 100 W.

No. 8000-SR equipped with No-Rol cage of zinc plated wire. Polished wood handle with LEVOLIER* Switch. Lamp size — 40-100 W. (*T.M. Reg U.S. Pat. Off.)

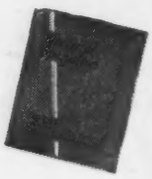


No. 4675 uses polished wood handle with LEVOLIER* Switch. Cage of zinc plated heavy steel wire Lamp size — 25-100 W (*T.M. Reg U.S. Pat. Off.)

No. 1440 Wall Guard for protection of bulbs exposed to theft and damage Lamp size — 100 W

McGILL Adaptable Lamp Changers stop lamp changing hazards Safety insulated Convenient to use

Send today for McGILL Catalog No. 43 so that you can pick out the lamp guard that will most effectively solve your own problems.



McGILL MANUFACTURING CO., INC.

Electrical Division

450 N. Campbell St., Valparaiso, Indiana

repair department and one by the wiring department.

It is very simple, the main vertical member, of steel tubing, passing through another short piece of tubing of larger diameter which is fastened to the truck bed as shown in the sketch. It just clears the side of the truck body.

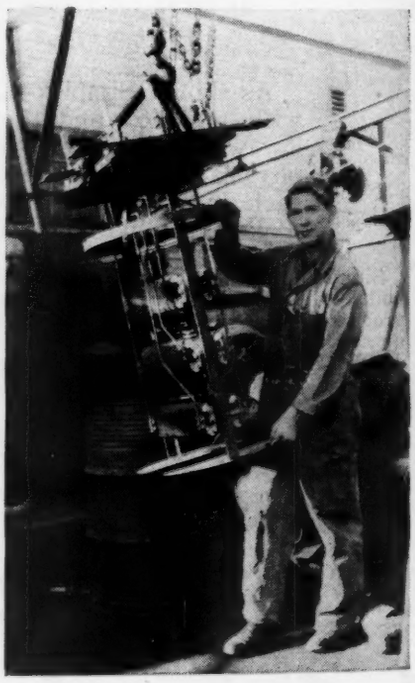
The boom member, the vertical of which is of larger diameter tubing, fits over the top and turns readily. Holes at the end of the boom permit attaching a hand hoist or any desired tackle.

The various advantages are: Simplicity—the whole thing can be knocked down into several parts easy to handle and transport on the truck. The load carried does not rest on any part of the truck but on the ground, and therefore does not tend to tip the truck but rather stabilizes it during loading and unloading. If it is necessary to load where ground is soft, a square block of wood under the end of the vertical member will hold it.

Water Cooled Resistor

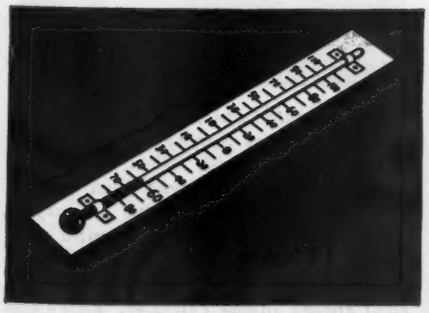
Vaughan Electric Service, Los Angeles, has built a resistor for loading generators and similar work, which does away with the old "salt barrel", with its attendant objections of corrosion, etc.

A steel drum is used for the container, having an inflow of clear, cold water at the bottom. After passing up through the eight resistor grids, it is

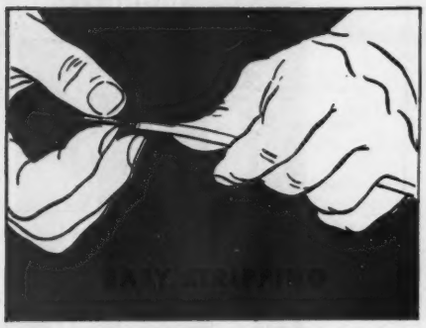


Resistor elements lifted from steel drum container, shows construction of assembly.

"Cold can't crack this wire ...It's Laytex RU"



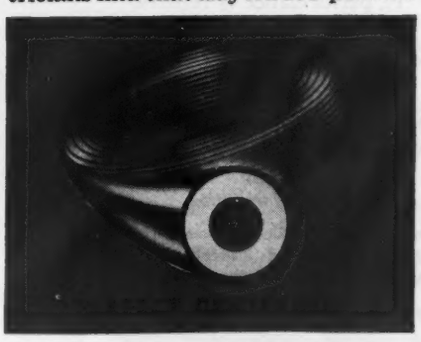
"Even at temperatures of –60 degrees Fahrenheit, Laytex RU will not crack," says Mr. USRUBBY, the Wire Engineer. Nor will Laytex soften at high temperatures. Electricians find that Laytex RU permits more wires per conduit, because it is America's smallest diameter natural rubber covered building wire. Its conductors are perfectly centered in the insulation. There are no dangerous thin spots. Laytex RU is easily



and quickly stripped. Moreover, the insulation can be rolled back to the braid—and back again over the barrel of the terminal. Laboratory tests prove that Laytex is tops in tensile strength. It will withstand an

unprecedented amount of stretch before breaking, and in all other physical and electrical qualities far exceeds other building wires. U. S. Laytex RU carries the label of the Underwriters' Laboratories and is listed in the National Electrical Code as an all-purpose wire. Send today for sample plus booklet containing more details about Laytex. Write Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

Reg. U. S. Pat. Off.



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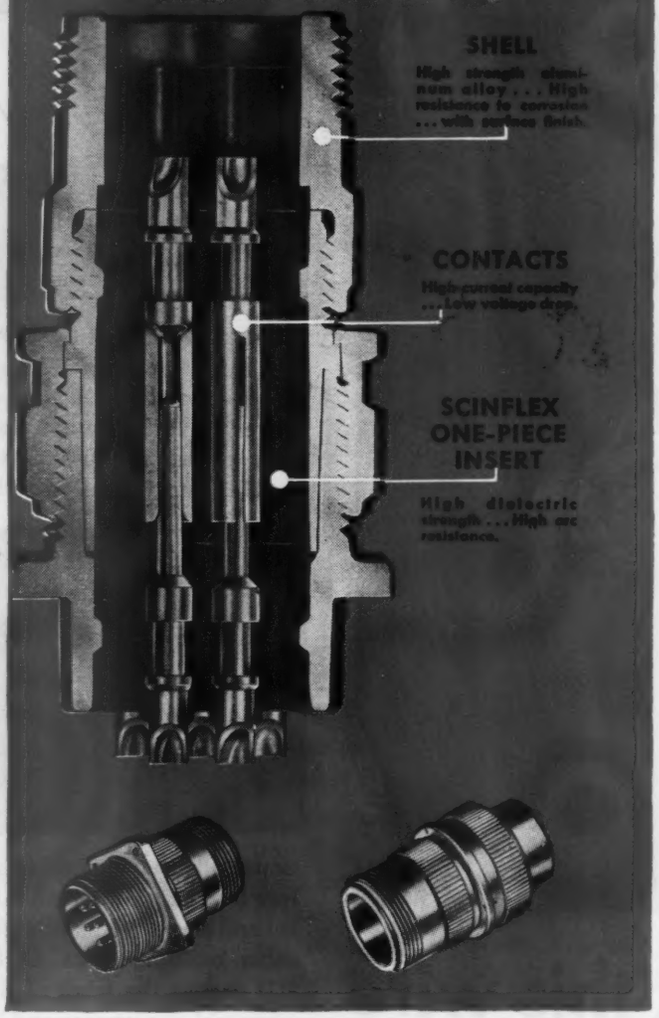
SHELL
High strength aluminum alloy . . . High resistance to corrosion . . . with surface finish.
CONTACTS
High current capacity . . . Low voltage drop.
SCINFLEX ONE-PIECE INSERT
High dielectric strength . . . High arc resistance.

AND THE SECRET IS SCINFLEX!

Bendix-Scintilla* Electrical Connectors are precision-built to render peak efficiency day-in and day-out even under difficult operating conditions. The use of "Scinflex" dielectric material, a new Bendix-Scintilla development of outstanding stability, makes them vibration-proof, moisture-proof, pressure-tight, and increases flashover and creepage distances. In temperature extremes, from —67° F. to +300° F., performance is remarkable. Dielectric strength is never less than 300 volts per mil.

The contacts, made of the finest materials, carry maximum currents with the lowest voltage drop known to the industry. Bendix-Scintilla Connectors have fewer parts than any other connector on the market—an exclusive feature that means lower maintenance cost and better performance.

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Write our Sales Department for detailed information.

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Available in all Standard A.N. Contact Configurations

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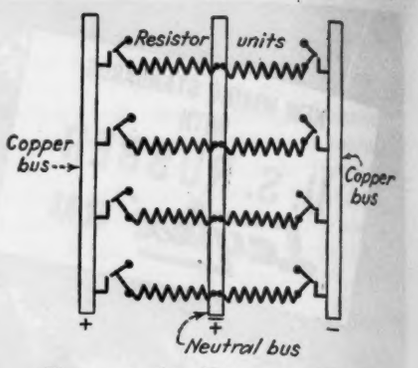
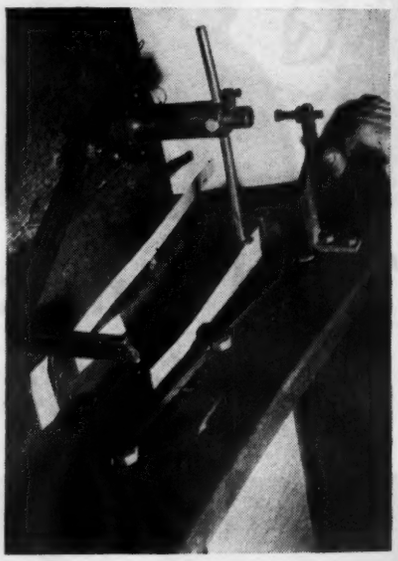


Diagram of resistor connections

discharged as warm water at the top. The resistors used are Ward Leonard, of the edge-wound type, good for 250 amperes on each unit at 250 volts. On the horizontal panel mounting are three bus bars—positive, negative and neutral, with switches connecting resistors to bus bars as shown in diagram.

There are three common uses for the equipment. (1) To check 250 volt, 3-wire connection. (2) For balancing conditions. (3) For running continuous loads for long period of time in checking generators.

Incidentally, it may also be used as a starting rheostat for starting large d-c motors and as a speed-regulation grid to start large slip-ring a-c motors.



Spring-actuated guide bar on insulation cutting table at Springfield Armature Works, Springfield, Ohio, simplifies cutting chore. An eight inch adjustable guide bar (for width of cut) is mounted horizontally in a round steel rod which telescopes into cylindrical pedestal. Rod rests on strong cylindrical spring inside cylinder. Extension arm with adjustable contact bolt is attached to cutting blade lever. As blade nears end of cutting stroke, extension arm depresses guide bar rod. Opposing force of spring in cylinder prevents "snapping action" of blade which, combined with the gradual lowering of guide bar, eliminates kinking and bending of paper.

Modern Lighting

FIG 1—Recessed incandescent direct lighting provides high intensity general lighting throughout the Manhasset, L. I. suburban store of B. Altman & Company. Fluorescent lighting is used in floor and wall cases, and in indirect coves.

New Type Shielded Units Light Store

Well planned modern lighting features the new suburban store of B. Altman & Company, New York City department store. This new suburban store, located on a high ridge on Northern Boulevard in Manhasset, Long Island, overlooking the swank residential section of Munsey Park and Strathmore, combines good daylighting through large area glass windows and unique and effective artificial incandescent and fluorescent lighting. The two story building has convenient entrances on both the main floor and first floor levels, making it easy for pedestrian or motoring shoppers to reach departments on either floor from the outside of the store.

General lighting throughout is provided by direct lighting units recessed flush in the ceiling. These units (Fig. 3) are equipped with 150 watt PAR-38 reflector lamps, and spaced on approximately eight-foot centers. A new principle for shielding the lamps has been used in these units. Three circular flat disks, each having a 5¼-inch diameter center opening, are spaced 1¼-inches apart, one above the other. The entire interior of the unit is finished dull (velvet) black to prevent specular reflection of spill light from the visible interior parts of the unit. A 10-inch diameter flat face plate installed flush with the ceiling surface also has a 5¼-inch diameter center opening, and provides a finished appearance to the unit. The exposed surface of the face plate is painted light cream to match the color of the ceiling.

Indirect lighting from continuous coves provides ample light on the ceiling and side walls to relieve undue brightness contrasts and prevent the ceiling from appearing dark. In wall areas where wall cases exist, one continuous row of fluorescent lamps, installed on Garcy wiring channel, serves a double purpose by providing indirect lighting on the ceiling and upper side walls, and direct lighting in the wall cases (Fig. 2).

Slimline fluorescent lamps are used to light floor showcases throughout. These lamps are housed in small neat Garcy showcase reflectors which are concealed by the wood trim framework of the cases.

Free standing models and feature merchandise displays are lighted by re-

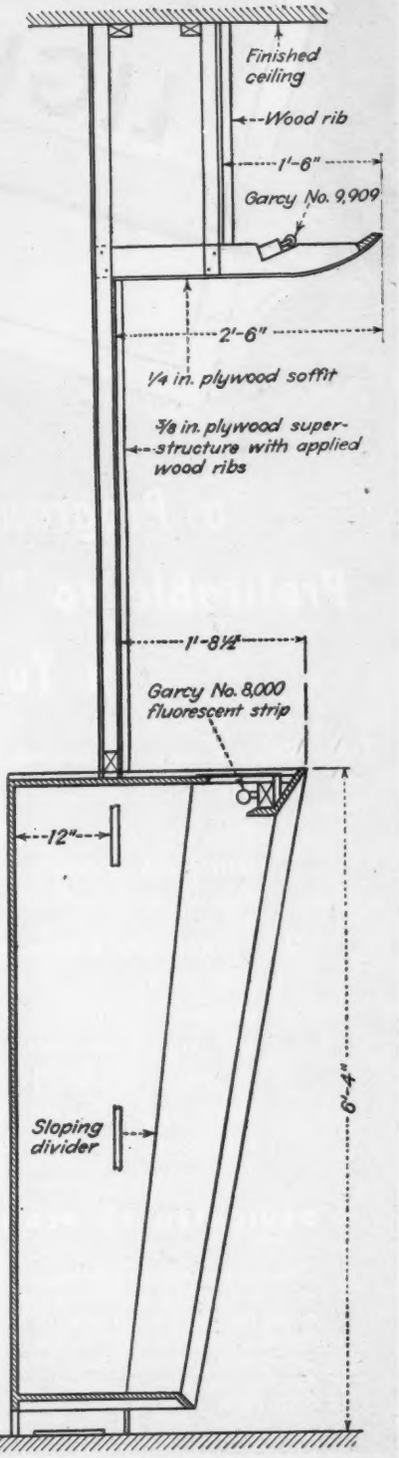


FIG. 2—Wall cross-section shows lighting detail for wall display case and indirect cove. Diffusing glass is installed over the fluorescent lamps which light the wall cases, providing diffuse light on the wall area above. Varied decorative treatments on walls add variety to the decorative scheme of this department store.

a Program You'll Find Profitable to "CHAMPION" in Your Plant

You can take that two ways — both of them good business for you.

1. *Planned Lighting* is a cause worth *championing* from every standpoint — quality and quantity of output, worker morale, accident reduction, long-run economy.

2. CHAMPION Fluorescent and *Incandescent* Lamps for your planned lighting program give you efficient, dependable industrial lighting. CHAMPION manufacturing, testing and control methods assure lamp quality that is second to none. CHAMPION's policy of low overhead and clean-cut distribution through selected industrial distributors assure minimum lamp and lighting costs.

DEDICATED TO PLANNED LIGHTING

This modern plant and everyone in it is working night and day to implement your planned lighting program with the finest lamps that can be produced by modern equipment backed by forty-eight years of experience.

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Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

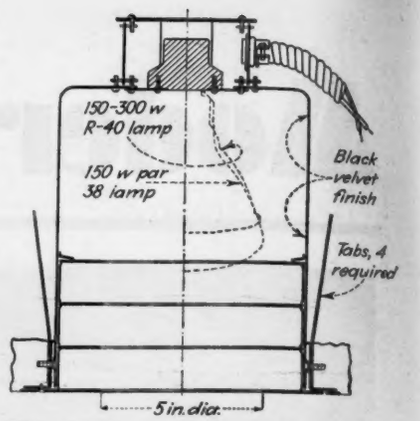


FIG. 3—Recessed downlight used for general lighting uses new principle for shielding spill light from glare angles.

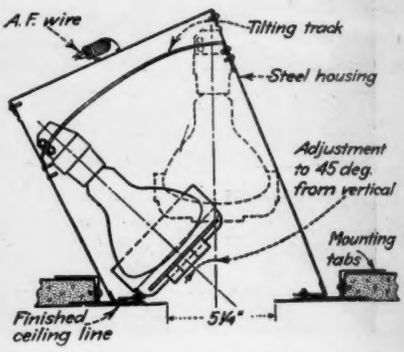


FIG. 4—Recessed spotlight housing has adjustment to 45-degrees from vertical for spotlight reflector lamps.

cessed adjustable spotlights (Fig. 4), using 150 or 300-watt R-40 type spotlight lamps.

All lighting has been carefully planned to provide maximum utilization where most needed, and to supplement the colorful and effective decorative treatments throughout. Thus light and decorations supplement each other to create a most harmonious and cheerful atmosphere, and varies from one department to another so that the setting for the merchandise on display is appropriate.

The shielded downlights are inconspicuous (Fig. 1), yet provide high intensity light of good color quality over the entire sales floor area. Since fluorescent lamps are used primarily for decorative lighting, its contrasting color quality adds to the already colorful decorative effect.

Architects for this store were Alfred Hopkins and Associates, New York City. Interior decorations were planned by Amos Parrish & Co., Inc., who coordinated their work closely with Thomas Smith Kelly, lighting consultant who planned the lighting. Century Lighting Co., Inc., New York, furnished the recessed downlights and adjustable spotlights, and Garden City Plating & Manufacturing Co., Chicago, furnished the cove lighting equipment and reflectors for floor and wall cases.

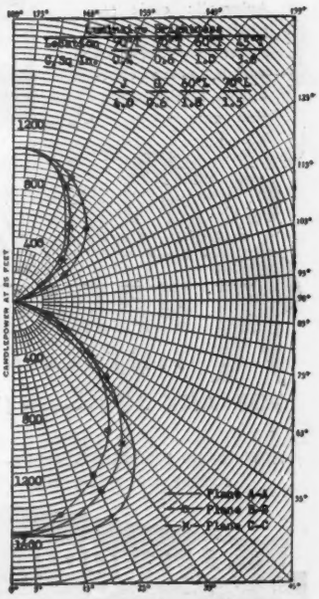
CURTIS
Forty-Sixty-One
FOR TWO 100 WATT LAMPS

A SIMPLE SOLUTION FOR DIFFICULT PROBLEMS

News from all quarters of the world focus to a point in the news room of the Chicago Tribune. It comes in 24 hours a day . . . each shift is under tension and each person requires LIGHT . . . lots of it . . . constantly and without glare . . . regardless of architectural problems, such as a twenty-five foot ceiling!

Here the Curtis "Forty-Sixty-One" proved the perfect solution from all angles. Its direct component provides ample illumination at the working surfaces. Its indirect component (approximately 40%) reflects from the ceiling and diffuses into the room to create comfortable seeing conditions throughout. The 25° louvering shields direct view of the lamp from normal angles.

The "Forty-Sixty-One" is identical in construction and dimensions with the "Forty-Sixty," except that it is 60¾" long and is designed for two 100 watt lamps. It can be furnished with single stem hangers for continuous runs or as above illustrated for individual installation.



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WHEN YOUR JOB CALLS FOR TIME SWITCHES

Specify **Paragon**

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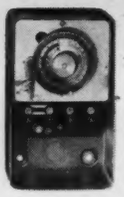
"On-off" time switch. Controls stokers, oil burners, pumps, commercial lights, signs, etc. 3000 watt cap.



700 SERIES

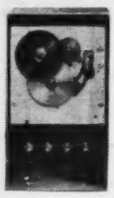
7-day calendar dial for control of automatic heating, ventilating and air conditioning systems.

G SERIES

Heavy duty "on and off" control for commercial and industrial applications. Also 2-circuit types.

J SERIES

Automatic cycle repeater control for stoker hold-fire, batch mixing, pump operation, liquid agitation, etc.



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NEW TRADE DISCOUNTS APPLY—ASK YOUR JOBBER OR WRITE FOR DETAILS

Paragon ELECTRIC COMPANY

1614 TWELFTH ST.

TWO RIVERS, WISCONSIN

BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

Fluorescent troffers provide average intensity of 44 footcandles in the Housewares store of the Corning Building Co., Corning, N. Y., with 2.2 watts per square foot in Miller Company troffers.

Troffers Light Housewares Store

An average lighting intensity of 44 footcandles is provided by a lighting load of 2.2 watts per square foot, in the Housewares store of the Corning Building Company, Corning, New York. This average of 20 footcandles per watt per square foot is obtained from a fluorescent flush troffer lighting system, using Miller Company troffers installed in a 13-foot high ceiling.

The troffer units use two 40-watt 4500-degree white fluorescent lamps per four foot length of troffer, installed in twelve foot long sections. These sections are spaced on 8-foot centers, and installed flush in the acoustical tile ceiling.

The floor in this store is of marbellized ivory tile, and counters are pearl gray and natural wood finish. Side walls are pearl gray and light blue, while the acoustical tile ceiling is an oyster white. Enough light is reflected upward from these light colored surfaces to light the ceiling softly and to prevent undue brightness contrast between the ceiling and the lighted troffer surfaces.

The concentrating effect of the light distribution from the troffers can be observed in the photograph of this store interior (above). This is demonstrated clearly by the graduated lighting intensity on the columns, low in brightness near the ceiling, and increasing in brightness towards the floor. The reverse effect would obtain from a wide distribution type of unit, installed either flush or on the surface of the ceiling.

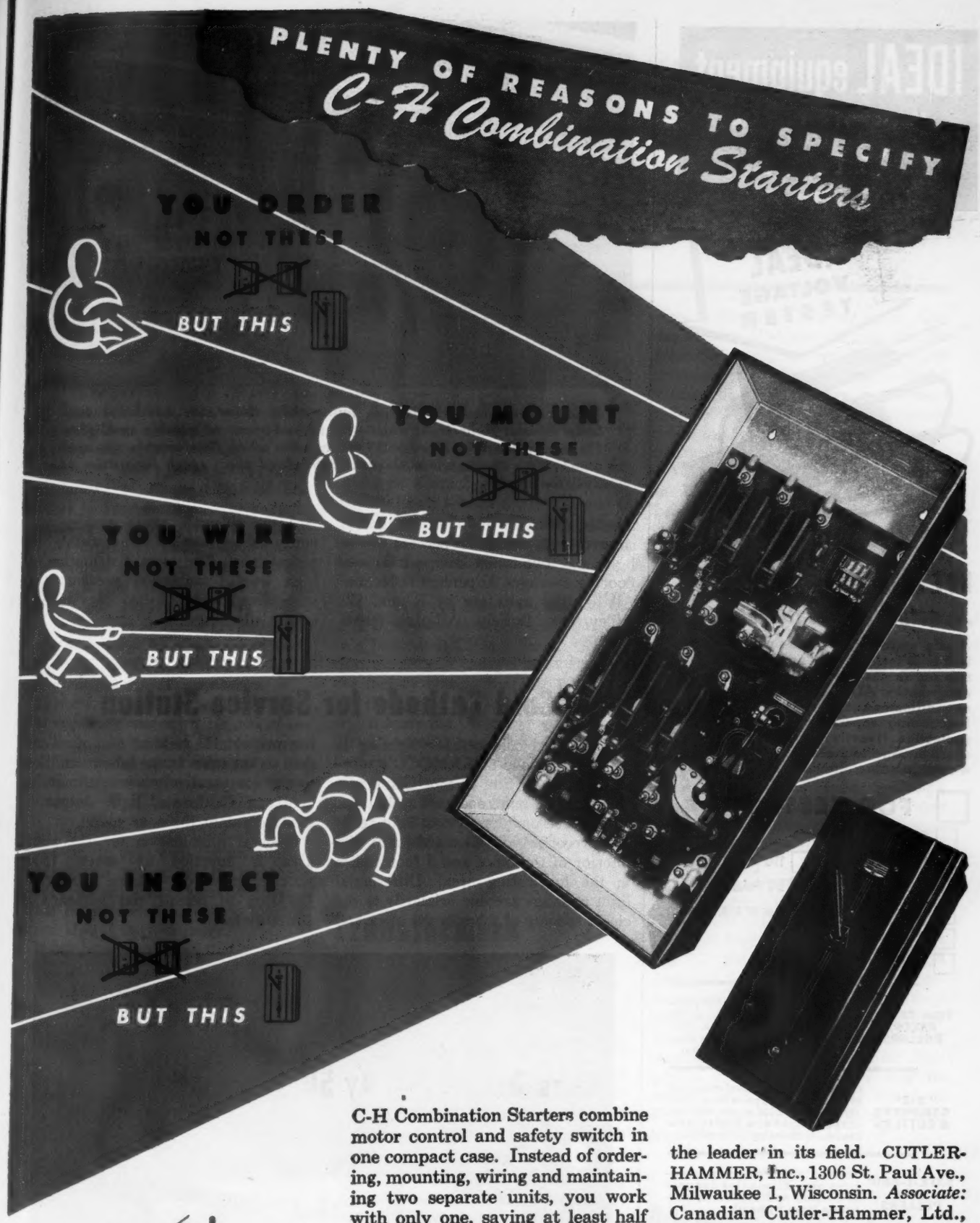
The H. K. Ferguson Company were the designing engineers for this installation.

Cars Displayed By 50 Footcandles Plus

The Plymouth-DeSoto showrooms of Downtown Motors, Buffalo, New York, were recently relighted with a combination of recessed troffers and adjustable spotlights. Troffers are two-lamp units, containing white 40-watt T-12 fluorescent lamps, shielded by opal glass panels. Fluorescent units are mounted in pairs end to end. Between each pair of fixtures, and at the ends of all rows of lamps, incandescent R-40 spotlights are mounted with provisions for swivelling the units to the desired azimuth and declination in order to direct highlighting beams to specific areas. The rows of incandescent and fluorescent fixtures, recessed into the 9-foot acoustical ceiling, are spaced on 8-foot centers. In all, there are 88 fluorescent units and 53 adjustable spotlights in the illumination plan for the 5000 square foot showroom.

With only the fluorescent lamps in service, illumination intensities average 50 footcandles at auto hood levels, resulting in a coefficient of utilization of 35 percent. Augmented by light from the adjustable spots, the highlighted areas approach a 200-footcandle intensity. Acoustical tile ceilings have

PLENTY OF REASONS TO SPECIFY *C-H Combination Starters*



YOU ALSO SAVE SPACE

C-H Combination Starters combine motor control and safety switch in one compact case. Instead of ordering, mounting, wiring and maintaining two separate units, you work with only one, saving at least half the installation time, saving on conduit, wire and fittings, saving in space, saving inspection and maintenance time and trouble. In addition, you get world-famous C-H eutectic alloy overload relay protection, dust-safe vertical contacts, many other important features that have established the C-H unit as the leader in its field. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

CUTLER-HAMMER
MOTOR CONTROL
C-H

IDEAL equipment
MAKES THE JOB
Easier

The New
IDEAL VOLTAGE TESTER

NOT an ordinary "Glo" Type
... actually indicates voltages

A safe, sturdy, pocket-size voltage tester that tells instantly the nominal line voltage on an easy-to-read calibrated scale and whether AC or DC. A solenoid voltage indicator and a new test lamp—each functioning separately provide double protection. Heavily insulated test prods—sharp enough to pierce insulation—have 4-inch handles. Includes carrying case.

FOR TESTING

- ☐ Continuity of circuits
- ☐ 110 to 500 v. AC ☐ 110 to 600 v. DC
- ☐ Blown fuses ☐ DC Polarity
- ☐ Grounded side of line, motor or appliance
- ☐ Frequency (25 or 60 cycle)
- ☐ Excessive leakage to ground

FISH TAPE, REELS, PULLERS — Gives a sure, safe grip for pulling. Keeps tape reeled to avoid contact with "live" parts. Protects the hands. Eliminates slippage, kinks, bends or breaks.

"E-Z" STRIPPERS & CUTTERS — Clamps wire, cuts insulation and strips in one operation. For stranded or solid wire—will not crush stranded wire. Replaceable blades. Eliminates wire waste.

SAFE-T-GRIP FUSE PULLERS — Formed to fit the fingers — positive grip. Eliminates dangers of pulling and replacing cartridge fuses by hand.

IDEAL INDUSTRIES, Inc., Sycamore, Illinois

IDEAL

Distributed Through
AMERICA'S LEADING WHOLESALERS

Illumination plan of Buffalo automobile showroom combines two-lamp 40-watt fluorescent units with incandescent adjustable spotlights. Lighting intensities average 50 footcandles when fluorescents are used alone. With spotlights in service, highlighted areas reach intensities of 200 footcandles.

a reflection factor of 70 percent, cream colored walls reflect 55 percent of the light and two-toned composition tile flooring averages 30 percent reflection. All lighting units are by R. and W. Wiley, Inc., Buffalo. All-glass fronts face the sidewalk areas, making the entire showroom plainly visible to pedestrians. The even distribution of high level illumination presents the streamlined and polished cars to excellent advantage.

Cold Cathode for Service Station

Unshielded cold cathode lighting is used to light one of SAMOCO's service stations in San Diego, California. Tubing is 25 mm., operated at 120 ma. After three months service, light readings recorded 35 footcandles in the interior of the office and 8 footcandles in the lubricating area. Differential light readings are due primarily to the closer spacing of tubes in the office and the unavoidable residual film of oil and dust on the tubes in the lube room. Due to the comparatively warm climate of southern California, light output is fairly constant the year round.

General illumination for the pump area is supplied by seven 1500-watt Benjamin duo-service floodlights. Lighting of pumps and billboard is conventional.

Cold cathode lighting is utilized in warm climate to light office and lubrication areas of service station. Due to warm temperatures, light output remains relatively constant in summer and winter.

Answered by
F. N. M. SQUIRES and GLENN ROWELL

New York Board of Fire Underwriters
Chief Inspector
New York, N. Y.

Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

Questions on the Code

Hazardous Locations

Q. *The presence of a properly installed L.P.G. hot water heater apparently does not require any special electrical wiring precautions.*

However, there are many recent installations of small industrial heat devices in basements such as radiator compound cleaners, printers' lead remelters, degreasers, meat smoke houses, using liquid petroleum gas fuel and without safety shut off or pilots. If a leak in gas supply or flame failure should develop, it seems an explosion could be set off by operation of ordinary open electrical switch for say a refrigeration compressor nearby.

Is there any opinion or ruling available requiring under article 500 of the National Electrical Code explosion-proof wiring in areas adjacent to the L.P.G. installations without safety accessories?—H.H.H.

A. Article 500 of the Code is set up to deal with the installation of electrical equipment in what are judged to be "Hazardous Locations". What constitutes a hazardous location is not always easy to judge.

It has been considered that consideration should be given to "normal operation" of equipment. That is, if explosive atmospheres are not present under normal operations a place should not be judged to be a hazardous location.

If we were to go by what *might* happen—every basement which has a gas meter or gas pipes in it, as well as every kitchen which has a gas stove in it, would be a hazardous location just because a gas leak might develop. If we look, however, at section 5004 a, location (1) we will note that "normal operating conditions" are considered, and in location (2) the hazardous concentration of gases have to exist *"frequently"* in order to have the place considered as a hazardous location. An infrequent leak would not be a basis for a requirement for equipment to be of the "explosion-proof" type.—F.N.M.S.

Fixtures for Grain Elevators

Q. *We have been able to find a number of vaportight fixtures and would like to use them in several grain elevators, as we cannot get delivery on Class 2 fixtures. They look exactly like a labeled Class 2 Group G fixture that we hung previously. Should we ask the inspector to accept them as being O.K.*—S. C.

A. No, you should not ask the inspector to accept them for use in a hazardous Class 2 Group G location unless you can get a letter from the factory stating that the fixture is identical with the one they produce which bears the Underwriters' Laboratories approval as a Class 2 Group G fixture. Fixtures suitable for operation in a dusty location must be capable of dissipating the heat generated by them when covered with dust without charring the dust on them.—G. R.

Transformers Ratings

Q. *We are just beginning the installation of neon tube lighting in a night club and are wondering if the Code will permit us to place the sign transformers in plywood cabinets set in wall recesses so they can be hidden when the decorations have been completed.*—M. C. E.

A. If the transformers are of the approved enclosed dry or askarel insulated type, they might be located within ventilated plywood cabinets provided they did not raise the surface temperature of the plywood above 194° F. This will be found under Sections 4195 and 4197 of the N. E. Code. Your use of the term sign transformers suggests that you may not as yet be familiar with the limit placed on transformer ratings used to supply electric discharge lighting tubes. Under Section 4194 you will note that the transformer ratings are limited to 240 milli-amperes when the open circuit voltage of the secondary is not more than 7500 volts and to 120 milliamperes when this voltage exceeds 7500 but is not more than 15,000 volts.

If the building in question is within the corporate limits of your city, it will be advisable to check with your inspector before placing the transformers within the plywood cabinets as many cities require that the transformers be placed within metal enclosures.—G. R.

Local Fire Alarm Systems

Q. *I cannot find any regulations or rules concerning fire alarm systems for apartments, public buildings, schools, rooming houses, etc. Could you give some details or regulations covering such installations?—J.H.H.*

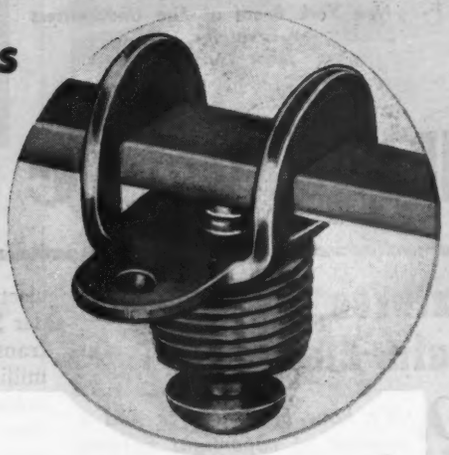
A. The information desired is not found in the National Electrical Code but is to be found in the National Board of Fire Underwriters' Pamphlet No. 72. This is the National Board's Standard for the installation, maintenance and use of Proprietary Auxiliary and Local Systems for Watchman, Fire Alarm and Supervisory Service as recommended by the National Fire Protection Association. Copies may be secured from the National Board of Fire Underwriters, 85 John Street, New York City.—F.N.M.S.

Bare Neutral

Q. *I recently received a red tag on a job because I placed a bare neutral conductor in a three wire service conduit supply 115–230 volts to a dwelling. Has the Code been changed to forbid this?*—M. A. R.

Turn to KNIGHT

For Smart Ways Out of Tough Spots



The KNIGHT Stud attached to Bar Hanger

The KNIGHT Bar Hanger Stud

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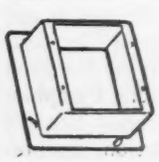

Other outstanding Knight products are: CONCRETE OUTLET BOXES, HUNG CEILING BOXES, VERTICAL AND HORIZONTAL I-BEAM CLAMPS *with Box or Pipe Supports,* STEEL DOOR BUCK BOX SUPPORTS, SQUARE AND OCTAGON BOXES, THIN WALL PARTITION BOXES, GANG BOXES, BAR HANGERS, ETC.

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ELECTRICAL PRODUCTS CORP.

1357-63 Atlantic Ave., Brooklyn 16, N. Y.

A. No, the Code still permits the use of the bare neutral provided the nominal voltage to ground is not in excess of 208 volts. You will find this under section 2303a, but in areas in which radio reception is poor, many municipalities have enacted ordinances which are designed to lessen radio interference. The use of a bare neutral in a grounded service raceway will cause a certain amount of noise whenever the load is unbalanced and the conductor happens to make or break contact with the enclosing conduit. Hence you will find such practice is often prohibited in poor reception areas.—G. R.

Motors In Garages

Q. *Here is a question that I will appreciate someone answering. It deals with fractional hp. short time or intermittent duty motors in garages where there are from 10 to 50 cars along with automobile repairing. These motors are in every case single phase with cord acting as controller and disconnect plugging into receptacles 48 inches above the floor. These fractional hp. motors are used on grinders, buffers, emery wheels and also valve grinders. They are of the totally enclosed type and are air and abrasive tight due to the necessity of keeping abrasives out, although they are not intended to withstand an internal explosion.*

Section 5103 of present Code states that motors (I am discussing motors only) must be approved for use in Class 1, Division 2 of Article 500. Approved for use means, as I understand it, acceptable to the authority enforcing the Code. There are no motors made, large or small, that are labeled by the Underwriters' Laboratories for use in buildings coming under Class 1, Division 2 of the Code. This Section 5103 refers to motors having make or break or sliding contacts which we would interpret to mean that are exposed and which would not include a totally enclosed fractional hp. single phase motor, regardless of what interior contacts it might have.

My question is—do these totally enclosed fractional hp. single phase motors, which are of periodic or short time duty, and which are tight enough to exclude all air and abrasives, class as being approved devices for use in garages when below the 4 foot level? Apparently, the only one that could pronounce them as being approved would be the authority enforcing the Code in the district where this question

5 FACTS YOU SHOULD KNOW...

1. About Varnished Fiberglas* Cloth and Tape.

Fiberglas continuous-filament fabrics are impregnated and coated with high-quality varnishes to meet the increasing demand for a strong, flexible cloth or tape insulation having outstanding dielectric strength, excellent resistance to heat, moisture and acids, plus dimensional stability. All the inherent characteristics of an inorganic material are incorporated in the base fabric. Properly impregnated, it provides heat resistance, high thermal conductivity and insurance against the effects of overload.

2. Where They Are Used.

Varnished Fiberglas cloth and tape are used as transformer sheet insulation, coil and bus-bar insulation, slot and end winding, phase insulation, cable wraps, etc. They are ideally suited for applications requiring heat resistance, high mechanical and dielectric strength, resistance to the effects of acids, oils and moisture . . . wherever greater protection against insulation failure is desired.

3. Sizes and Thicknesses.

They are available in finished thicknesses of .003″ through .030″ in both sheet and tape form. Standard rolls of sheet material are supplied in 25, 50 or 100 lineal yards, 36″ wide. Standard tape rolls are 36 and 72 yards long in widths up to 6″ . . . bias cut tapes available in 51″ long strips. Black or yellow varnish.

4. Who Makes Them.

Manufacturers—

Acme Wire Company, New Haven, Conn.
Electro-Technical Products Div., Sun Chemical Corporation, Nutley, N. J.
Irvington Varnish & Insulator Company, Irvington, N. J.
Mica Insulator Company, Schenectady, N. Y.
National Electric Coil Company, Columbus, Ohio
National Varnished Products Corporation, Woodbridge, N. J.
New Jersey Wood Finishing Company, Woodbridge, N. J.

5. Who Sells Them.

. . . electrical distributors and representatives of the manufacturers listed above. If, by any chance, you are unable to locate a supplier, contact the Owens-Corning Fiberglas Corporation branch in your vicinity.

Varnished Fiberglas in the form of cloth and tape is but one of the many available forms of Fiberglas electrical insulating materials. A copy of the "Fiberglas Electrical Insulating Materials" catalog containing information on the complete line will be sent on request . . . Owens-Corning Fiberglas Corporation, Dept. 856, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

*Fiberglas is the trade mark (Reg. U. S. Pat. Off.) for a variety of fabrics made of or with glass fibers by Owens-Corning Fiberglas Corp.

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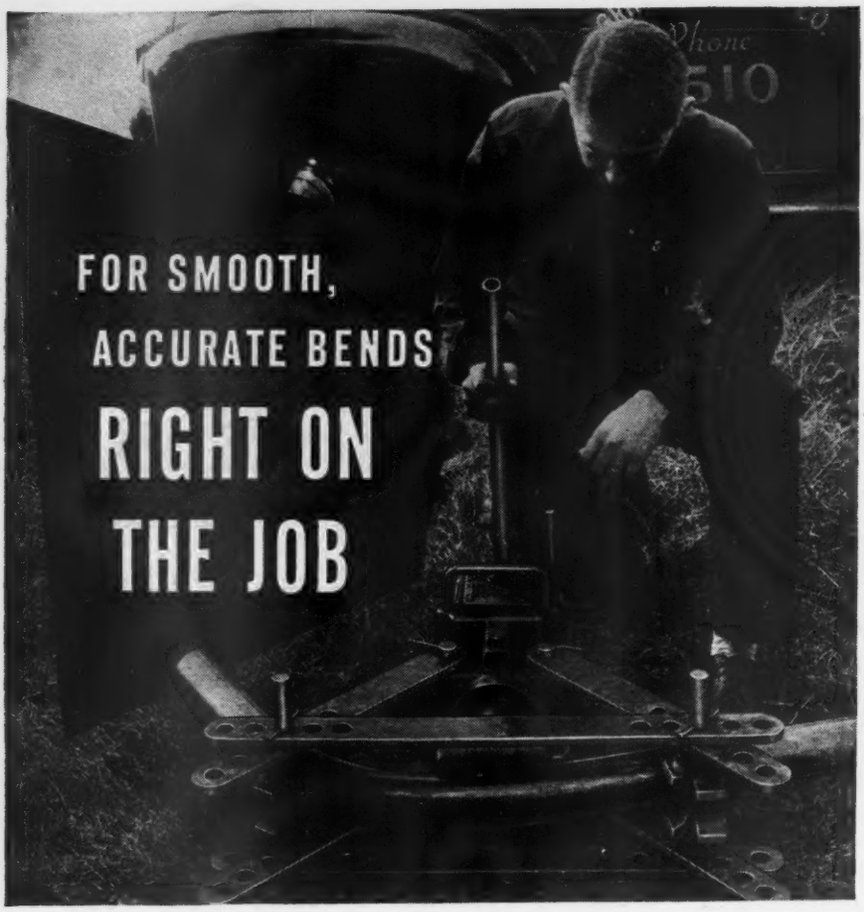
ELECTRICAL INSULATING MATERIALS

THERE IS A FORM AND TYPE OF FIBERGLAS ELECTRICAL INSULATING MATERIAL FOR VIRTUALLY EVERY INSULATION REQUIREMENT.



GREENLEE HYDRAULIC BENDER

Whatever the job location, the portable GREENLEE Hydraulic Bender can be taken *right to the spot* where the work is to be done.

Bends are quickly made exactly where and when wanted . . . tailored to the exact requirements of the installation. For example the GREENLEE Bender owned by the Griffin Electric Company of Owensboro, Kentucky, is shown above on job location where it was used to bend various sizes of conduit from ½" to 4½".

"Where promptness and swiftness are the main factors on a job, the GREENLEE is always used to save time and materials and eliminate need for manufactured fittings," reports this company.

With the GREENLEE, *one man* quickly makes smooth, precise bends in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. This means as high as 75% labor savings, many owners report, with material spoilage reduced to practically nothing.

Get facts today on the timesaving GREENLEE Hydraulic Bender which often pays for itself on the first few jobs. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1742 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

might be involved; nevertheless, an opinion from an authority on the subject will be appreciated. If they are not approved, the only motors that could be used would be those bearing the Underwriters' Laboratories label for use in Class 1, Group D areas; however, garages are in Class 1, Division 2 for Code requirements.—G.E.S.

A. Electric motors used in a garage lower than four feet above the floor would have to be of the explosion-proof type in order to comply with section 5103. Section 5018, paragraph b states that the type of motor mentioned above would have to be approved for Class 1 locations and a Class 1, Group D location would be the one into which the area of a garage below the 4 foot level would fall.

Some day motors having the centrifugal starting switch in an explosion-proof enclosure may be built, but it is doubtful. However, it is possible to have a relay to cut the starting coils in and out and to have these located externally from the motor and in an explosion-proof enclosure.

The direct answer to the third paragraph of the above question is that motors located less than four feet above the floor of a garage are required to be approved for use in Class 1 locations. These would be listed by Underwriters' Laboratories for Class 1 Group D locations.—F.N.M.S.

Lighting a Paint Spray Booth

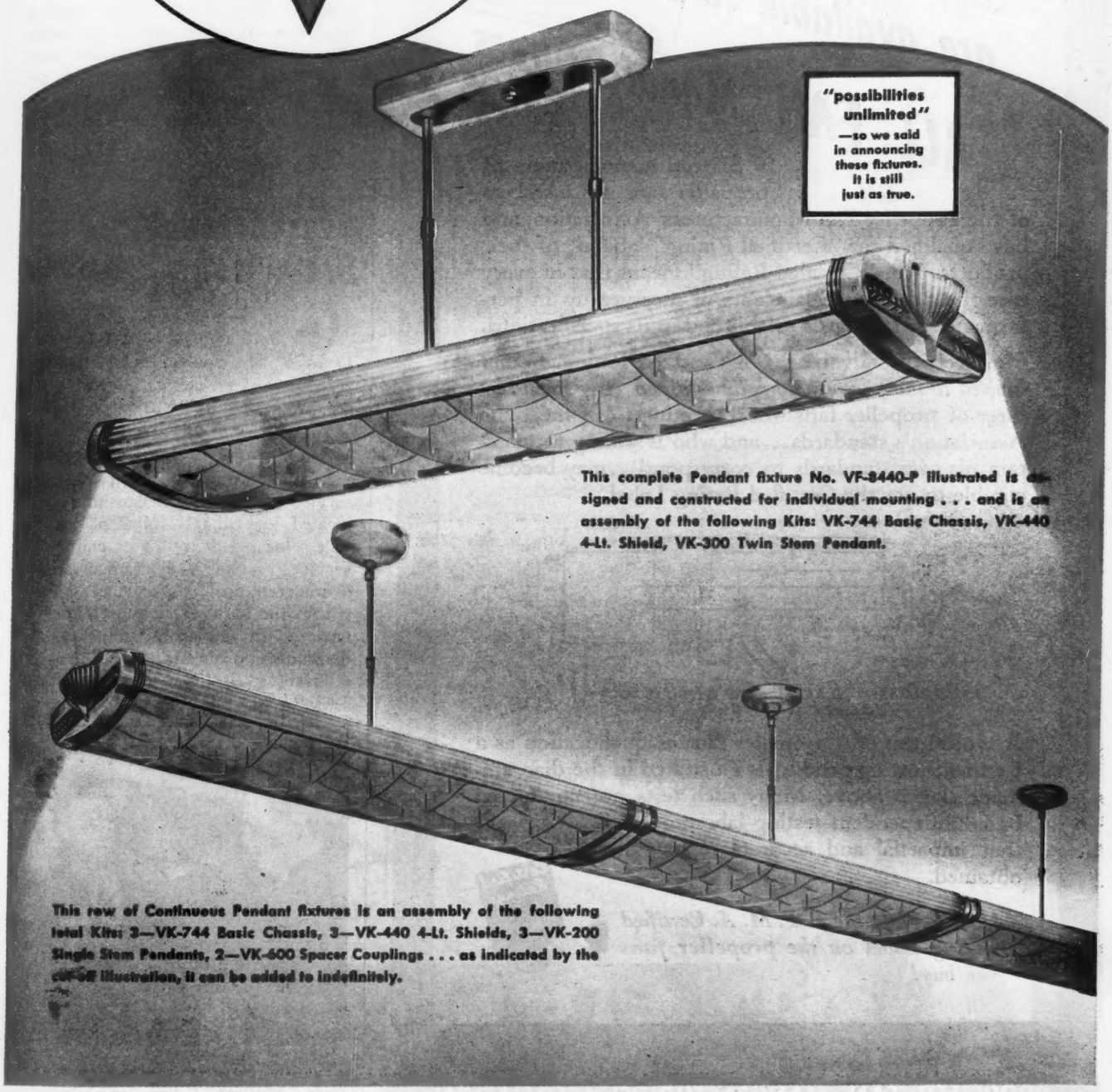
Q. *We are having some trouble in lighting a paint spray booth in such a manner that it will pass inspection. The inspector claims that we cannot use flood lamps mounted on portable pedestals even if we place wire glass shields in front of them. I have seen booths which were approved that had two glass enclosed lamps mounted on top of the open end, so I cannot understand why the flood lamp behind the wire glass shields would not be much safer. Can you explain the Code requirements?*—R. O. N.

A. The National Electrical Code under Section 5003 prohibits the use of portable lights. The illumination of the interior of paint spray booths through panels of wire glass or other transparent material is permissible only if fixed lighting units are used as the source of illumination. The other transparent material referred to is safety glass. However, national standards limit the maximum dimension of safety glass to 18 inches, hence very little use is made of this material.

VIRDEN VALUE

In fluorescent Virden is not only serious but highly interesting. Here are two sweet Virden fixtures that are definitely earmarked—"possibilities unlimited". Their beautifully clean lines—their perfect adaptability to every conceivable situation, are not the result of accident. They spell Virden value at all points.

See your Virden wholesaler.



This complete Pendant fixture No. VF-8440-P illustrated is designed and constructed for individual mounting . . . and is an assembly of the following Kits: VK-744 Basic Chassis, VK-440 4-Lt. Shield, VK-300 Twin Stem Pendant.

This row of Continuous Pendant fixtures is an assembly of the following total Kits: 3—VK-744 Basic Chassis, 3—VK-440 4-Lt. Shields, 3—VK-200 Single Stem Pendants, 2—VK-600 Spacer Couplings . . . as indicated by the cut-off illustration, it can be added to indefinitely.

John C. Virden Company • Cleveland, Ohio

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However, the advantages of Certified Rating *are not limited to these sixteen companies alone.* Any manufacturer of propeller fans whose products can meet the Association's standards...and who is willing to maintain his own standards to correspond...may become eligible to use the Certified Rating Label.

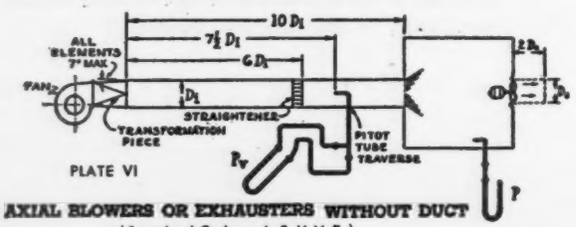

PLATE VI

AXIAL BLOWERS OR EXHAUSTERS WITHOUT DUCT
(Standard Code—A. S. H. V. E.)

A typical test of a propeller fan for qualification as a Certified Rating product is illustrated in the diagrammatic sketch above. Many such tests are conducted by an independent testing laboratory, so that impartial and accurate reports are obtained.

***LOOK FOR** the P. F. M. A. Certified Rating Label on the propeller fans you buy!*

Published by
PROPELLER FAN MANUFACTURERS' ASSOCIATION
5-208 General Motors Building
Detroit 2, Michigan

On certain types of booths vapor-tight fixtures may be used where mounted at the top on the open end. However, this position is not usually very satisfactory as it forces the operator to work in his own shadow. You will also note in this same section that lighting fixtures used for the illumination of a paint spray booth must be of the type approved for use in the atmosphere in which it is located. Therefore if there is no reason for combustible vapors or gases to exist outside the booth, ordinary fixtures may be used. However, this must be carefully determined as it is quite common to find dipping operations or other processes being conducted in the same room or area which might create a hazardous condition outside the booth. For instance, in an automobile body shop the Code would not permit the location of an ordinary fixture, even if fixed, when within four feet of the floor.—G. R.

Overcurrent Protection

Q. *When installing service to a building, is it always necessary to use a switch cabinet which contains fuse clips or can the fuse be placed in a separate box?*—E.W.

A. Section 2372 of the Code states that the service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto, unless located at the outer end of the service raceway. Therefore, if the overcurrent protective device is located within the building, it must either be enclosed in the same cabinet as the disconnecting means or be mounted adjacent to it in a separate cabinet. —G. R.

Bruce E. Ewers (left) electrical engineer, Phillips Petroleum Company, Bartlesville, Oklahoma quizzes John Gaythwaite, Sylvania Electric Products, Inc., on fluorescent and slimline lamp performance at Chicago lighting show.

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RoFlex

Rome's "easy to work" NON-METALLIC SHEATHED CABLE

EASY TO STRIP...LIGHT WEIGHT...SAVES TIME...

Further evidence of Rome Cable's ever broadening service to the electrical industry is RoFlex . . . the *new and better* thermoplastic insulated non-metallic sheathed cable. This latest addition to the "Rome" line now enables the wholesaler and contractor to specify "Rome" for his entire building wire needs.

RoFlex . . . meets all requirements of the man on the job. It is easy to strip, light weight, uniformly small in diameter, and clean to handle . . . the kind of cable the electrician calls "easy to work." Further, step by step, it is constructed for low-cost and trouble free installation.

FOR EXAMPLE:

1 The thermoplastic insulated conductors strip easily leaving bright, clean copper for quick connection. The insulation is highly resistant to oils, acids, moisture and flame . . . is permanently colored for quick and easy circuit identification.

2 A spiral wrap of specially treated paper covering each conductor provides light-weight, durable protection against mechanical injury . . . yet, strips back easily.

3 Impregnated jute fillers in each valley give the finished cable increased longitudinal strength, and serve as a "rip-cord" for stripping the outer braid.

4 The outer cotton braid is flame and moisture resistant. The uniformly small diameter saves space in oulet boxes and fits smaller holes.

Add them all up, and you have a cable that is easy to handle and quick to install . . . the result is savings for you. Remember the name . . . RoFlex.

UNDERWRITERS' APPROVED

Underwriters' approved for 60°C operation under the '47 National Electrical Code.

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

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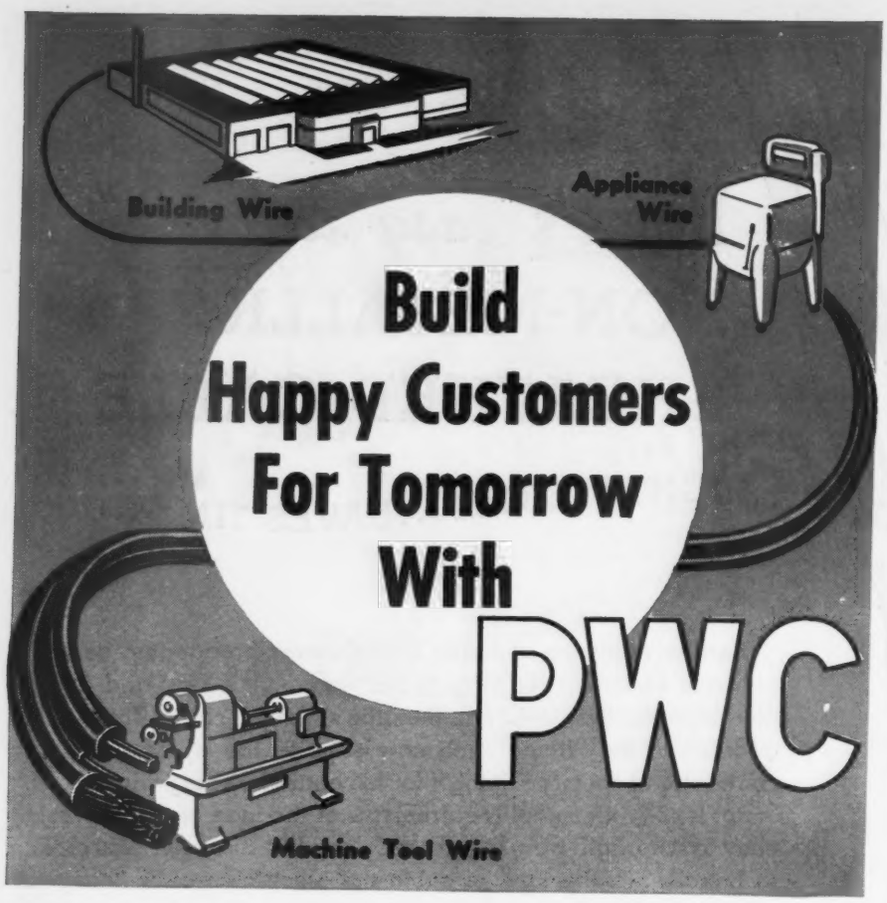


Whether you're wiring factories, office buildings, machine tools or major or small appliances, the finished job will be better because you have used PWC wires.

For PWC building wires, machine tool and appliance wires (UL approved to 80° C) have insulations that are super-aging, virtually immune to oxidation; that won't support combustion, thus eliminating the fire hazard of ordinary insulation. They're highly moisture resistant, not affected by vegetable, mineral or lubricating oils and greases, and there's no discoloration or corrosion of copper conductors.

Other PWC properties speed work to save labor costs . . . for instance: ease of stripping, pulling through conduits and color coding (up to eight standard colors, others on special order). And smaller diameters permit more wires in a given conduit or space.

Write us your requirements so that we can talk PWC performance on these or other wires or cables in terms of your specific needs.

PWC

PLASTIC WIRE & CABLE CORP.

403 East Main St.
Jewett City
Connecticut

NEW EQUIPMENT BRIEFS

[FROM PAGE 93]

lenbach Electrical Manufacturing Company, Los Angeles. * * Current **transformers** designed for both relay and meter work have been announced by Westinghouse Electric Corp., Pittsburgh. They are produced in ratings from 10 to 800 amp. with a full load secondary current of 5 amp. in all sizes.

A new electro pneumatic **time delay relay** incorporates a hold-in switch for remote pushbutton control. Manufactured by American Gas Accumulator Company, Elizabeth, N. J. * * An **electronic instrument**, called metals comparator, has been introduced by the General Electric Company, Schenectady, N. Y. for providing a comparison of either magnetic or nonmagnetic metal parts with a standard.

Bright Light Reflector Company, Bridgeport, Conn has announced an industrial **fluorescent lighting unit** called the "Economical Unit". It is a two lamp 40 watt open-end type, wired with 6 inch No. 18 AF wire leads. * * J. D. Whittle Co., Small Tools Division, Chicago, has introduced four new interchangeable portable **attachments for electric hand drill** and drill press:—(1) Saw and file attachment for hand drill only. (2) Three inch disc sander. (3) Saw and file attachment and (4) Screwdriver attachment. * * A program **timer** developed by Zenith Electric Company, Chicago, can be set to sound a bell or other signal at 15-minute intervals for 24 hours a day

The Mitchell Manufacturing Company, Chicago, announces a new **fluorescent troffer** recessed lighting system, available in two and three 40 watt; and two 40 watt with instant start, fluorescent lamps. * * A new **conduit clamp** announced by Industrial Devices, Inc., Edgewater, N. J. snaps on the conduit and stays in place, leaving the workman free to use both hands for the placing and fastening of the conduit to the wall or ceiling. It fits ½ inch EMT or ⅜ inch standard pipe. * * Ward Leonard Electric Co., Mt. Vernon. N. Y. announces the development of Bulletin 4451 **Size 1 a-c solenoid contractors** designed for use as main line, reversing or accelerating contactors on a-c motor controllers for machine tools, air conditioning equipment, pumps, compressors, etc. Also suitable for remote control of heater loads and tungsten or infrared lamp loads.

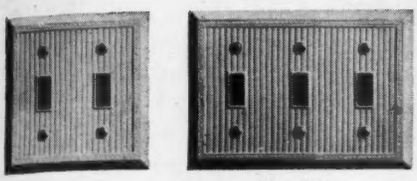
The Simplytrol indicating and controlling **pyrometer** is a thermocouple type direct contact making instrument. It is made by Assembly Products Inc., Chagrin Falls, Ohio. * * Neoline, Inc., Los Angeles, Calif., has announced the Neolock "105" **locking plug**, which has a wedge to force plug prongs

[Continued on Page 143]

IVORY and BROWN

FLUSH PLATES

FOR EVERY NEED!



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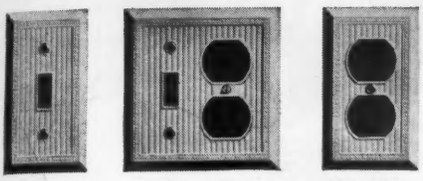

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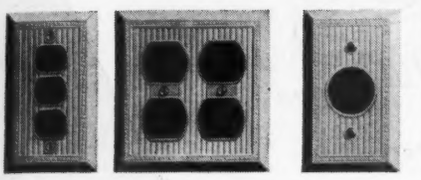

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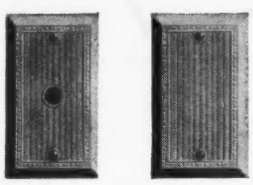


No. 116 No. 118

First quality heavy plastic — will not warp.

Engineered to prevent "splits" when installing.

Each plate packaged in an individual envelope complete with METAL screws.

One basic, universally popular design permits full stock with a minimum inventory.

LIST PRICES PER 1,000:

Singles: Brown $ 84; Ivory $100
Doubles: Brown $168; Ivory $200
Triples: Brown $252; Ivory $300

112-AP

AP

against the receptacle contact. It carries U/L approval. * * The small size BO power **relay**, available for either a-c or d-c coil operation has been announced by Allied Control Co., N. Y. C.

A packaged automatically switched distribution shunt **capacitor**, called Autotrol, has been announced by Westinghouse Electric Corp., Pittsburgh. Weatherproof, it is designed for operation on 2400 volt delta or 4160 volt wye distribution circuits. * * Momentary **welding currents** up to 50,000 amp. are provided by 15 to 25 hp. motor drives from a low voltage generator with a heavy flywheel, Progressive Welder Co., Detroit.

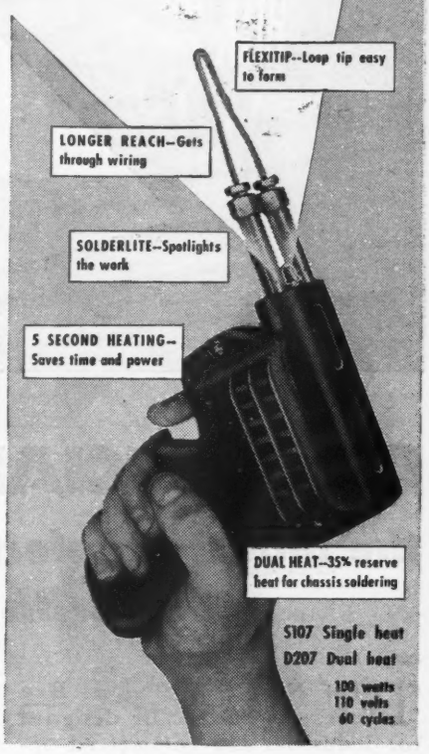
Capacitor start, high torque, **single phase motor** by Westinghouse Electric Corp. of Pittsburgh uses principle and method developed on their recent polyphase Life-line design. * * An a-c **generator** for 60 to 400 cycles uses a permanent magnet rotor eliminating exciter and slip rings made by Kober Electric Co., Arlington, Va.

Electronic intercommunication system manufactured by Dictograph Products, Inc., New York City, is available in 1-2-3-4 point hookup and uses substations with or without call-back feature. * * A line of Speedylectric steam **generators**, a new electrode type packaged unit, is designed to deliver up to 85 lbs. of steam per hour at 500 lbs. per sq. in. gage pressure and to provide accurately controlled processing temperatures up to 470°F is made by Livingstone Engineering Company, Boston, Mass.

The Den-El Equipment Co., Irvington, N. J. announces a new **fluorescent lamp guard** that supports the ends of fluorescent lamps and prevents their falling out of lampholders. * * The Superior Electric Company, Bristol, Conn. has developed a new Stabiline, (instantaneous electronic) **voltage regulator**, with negligible waveform distortion. * * A new industrial **powder-powered tool** named "Drive-It" has been introduced by the Powder Power Tool Corporation of Portland, Oregon. It drives anchor studs into concrete, punches holes through steel plate and rivets two steel plates together. * * A two or four light 40 watt **fluorescent commercial fixture** that can be used in one continuous run, plus a matching adjustable spot with a 360° swivel for accent lighting through a range of 120°, is made by Monogram Lighting Units, Inc., East Orange, N. J.

An adjustable **downlight**, known as "Dramatizer", made by Pittsburgh Reflector Company, Pittsburgh, Pa. is designed to provide lighting for spot displays, or places where concentrated light is needed. Surface mounted individually or in-line with fluorescent troffers, it may be adjusted to swing in a complete circle up to 35° from its vertical axis. A 150 watt, PAR-38 incandescent lamp with side-prong base is used. * * Insulated conduit-end **bushings** of plastic are announced by the Union Insulating Company, Inc., Parkersburg, W. Va.

FOR FASTER SOLDERING
2 NEW WELLER
SOLDERING GUNS
with
Solderlite



You can speed up and simplify the tough soldering jobs in electrical repair and maintenance work when you use the Weller Soldering gun with Solderlite.
Fast 5 second heating eliminates waiting time. Built-in spotlight finds the job faster, puts light right where you need it. Loop tip can get between wires; can be formed to get into corners.
Dual heat Model D-207 has 100/135 watts—enough heat to handle electrical maintenance jobs such as soldered connections encountered in motor rewinding, electrical and electronic control repair, instrument and meter work, etc.
See your electrical wholesaler or radio parts jobber.

WELLER
MANUFACTURING CO.
815 Packer St., Easton, Pa.

RCA SPECIAL RED TUBES

the industrial electron tubes with a minimum life of 10,000 hours!

THESE NEW RCA Special Red Tubes are specifically designed for industrial and commercial applications using small-type tubes but having rigid requirements for extra reliability and long tube life.

As contrasted with their receiving-tube counterparts, RCA Special Red Tubes feature vastly improved life, stability, uniformity, and resistance to vibration and impact. Their unique structural design makes them capable of withstanding shocks of 100 g for extended periods. Rigid processing and inspection controls provide these tubes with a minimum life of 10,000 hours when they are operated within their specified ratings. Extreme care in manufacturing combined with precision designs account for their unusually close electrical tolerances.

• • •

For your convenience, RCA industrial electron tubes are now available directly from RCA or from your local RCA Tube Distributor.

TABLE OF RECEIVING-TYPE COUNTERPARTS	
5691	6SL7GT
(0.6 A. heater)	(0.3 A. heater)
5692	6SN7GT
5693	6SJ7

RCA Special Red Tubes can be used in most cases as replacements for their counterparts in equipment where long life, rigid construction, extreme uniformity, and exceptional stability are needed.

SEND FOR FREE BULLETIN—Booklet SRT-1001 provides complete data on RCA Special Red Tubes. For your copy write to RCA, Commercial Engineering, Section BT 77, Harrison, N. J.

THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA

TUBE DEPARTMENT

RADIO CORPORATION of AMERICA

HARRISON, N. J.

LEADERS

RESIDENTIAL
•
COMMERCIAL

IN

LIGHTING

FOR

OVER

A

QUARTER

CENTURY

FLUORESCENT
•
INCANDESCENT

WRITE TODAY for Globe's two, colorful catalogs covering commercial and residential lighting.

GLOBE

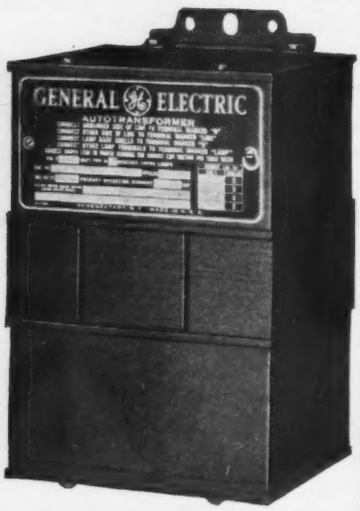
Established for over a quarter century

LIGHTING PRODUCTS, INC.

BROOKLYN, NEW YORK • LOS ANGELES, CALIF

NEW YORK Showrooms: 16 EAST 40th ST.

TULAMP TRANSFORMERS
make your mercury lighting COST EVEN LESS



High efficiency, long life, and sustained light output make mercury lighting the economical way to obtain better lighting in more and more industrial installations. G-E Tulamp transformers for mercury lamps increase your "more-light per-dollar" advantage by cutting installation and operation costs five different ways.

1. TRANSFORMER COSTS ARE LOWER: A Tulamp transformer costs less than a pair of single-lamp transformers.

2. POWER COSTS ARE LOWER: Combining two ballast units into one transformer provides more efficient operation.

3. WIRING COSTS ARE LOWER: High-power-factor operation by Tulamp transformers saves copper. Low starting current characteristic permits further reduction in wire size.

4. INSTALLATION COSTS ARE LOWER: With Tulamp transformers, only half the number of transformers need be installed—and installation is further simplified by carrying a common ground through to each pair of lamps.

5. FUSE PROTECTION IS BETTER: Starting current of Tulamp transformers is less than normal operating current, hence fuses for circuit protection may be rated down to the operating current values.

G-E Tulamp transformers are designed for both the H-1 400-watt lamp and the H-5 250-watt lamp. For fully co-ordinated design, specify G-E mercury lamps and transformers. For information on General Electric's complete line of mercury lamp transformers, address the nearest G-E Apparatus Sales office, or Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

412-90

ferrous and stainless steel alloys operates on slide-rule principle and is recommended for maintenance men. H. M. Harper Company.

(34) TEMPOTOOL — Two-color pamphlet describing uses, construction, procedure for using and range of capacities of tool for firing fastenings into steel or concrete. Tempo Products Co.

(35) SOLDERING IRONS — File sheet with description concerning electric soldering irons. Hexacon Electric Co.

(36) STREAMLINED LAMP STRIPS — Folder presents description, construction and characteristics of streamlined strip for covering outlets and fluorescent ballasts. Progress Manufacturing Co., Inc.

(37) BUILT-IN MOTORS — Two-color booklet describes rolled shell shaftless squirrel cage induction motors for built-in drives. The Louis Allis Co.

(38) TRANSFORMER MAGAZINE — Quarterly magazine is devoted to Techniques for Determining Quality of Materials and description and discussion of air-cooled indoor transformers rated at 2000 kva. and 15000 volts. Wagner Electric Corp.

(39) TEXROPE DRIVES—New 144-page catalog for pre-engineered stock Texrope drives is simplified so that non technical persons can correctly specify proper V-belts and drives. Allis-Chalmers Manufacturing Co.

(40) POWER PLANT—Fully illustrated booklet describes new 10-hp. engine developed for tractors, pumping units, conveyors, floodlights and welders. The story of power development is also included. D. W. Onan and Sons Inc.

(41) ELECTRIC FEEDRAIL—Compilation of recent developments in application of electric feedrail distribution systems as applied to portable tools, moving test lines, cranes and hoists is offered in 28-page catalog No. 20. Diagrams for layouts, mounting methods, sections for curves and transfers are included. Feedrail Corp.

(42) INDUSTRIAL FLUORESCENT TROFFERS—Medium weight and heavy duty equipment for both 40-watt and 100-watt fluorescent lamps is illustrated and discussed in catalog 1C covering both 50 and 100 Footcandler continuous wireway fluorescent lighting systems for industrial application. The Miller Co.

(43) MERCURY CONTACT RELAYS — Booklet described relays of electrical circuit element type, featuring small size, high sensitivity and constancy of

YOUR *Pipe Cutting* MADE EASIER

RIDGID Cutter rolls right thru any pipe—it's now efficiency-balanced

● You find it surprising how much the new balanced malleable frame of this RIDGID takes the work out of pipe or conduit cutting, helped by its special tool-steel cutter wheel, factory tested to assure perfect circle cutting. Quick and easy does it, as users world-wide can tell you. Choice of 5 sizes to 6″ pipe; 4-wheel cutters to 4.″ Seeing is believing—ask your Supply House.

4-wheel Nos. 42 & 44 for fast quarter-turn cutting.

Top Speed IN POSTER PIPE THREADING

Extra fast get-ready with this No. 1R RIDGID Threader for 1″ to 2″ pipe

● If you're partial to poster die stocks . . . here's the one you want. Changing dies is fast as any, but mistake-proof workholder sets faster—only one screw to tighten on pipe or conduit, no bushings to monkey with. You'll like the direct-action threading, too—straight line . . . handle to head to dies . . . no wabble. Sets of 4 precision chasers, 1″ to 2.″ Popular price—buy at your Supply House.

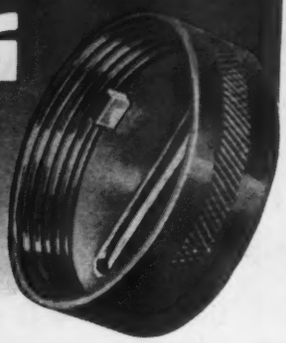
Stands up handily on its own feet.

RIDGID WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

New POSITIVE LOCK Construction of Monarch Renewable Fuses

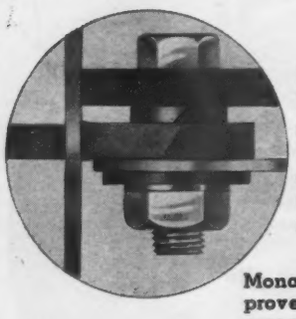
Assures → TRUE ALIGNMENT



The brass lugs inside the caps used on Monarch Fuses (see illustration at right above) fit into equally spaced slots in the brass casing inserts. This new and improved Monarch construction assures true alignment of the copper holding terminals . . . and establishes a positive lock on both ends of the fuse.

and for

STILL GREATER PROTECTION . . .



MONARCH'S Compressed Tension Lock Washer construction (illustrated at left) compensates for contraction and expansion of the fibre bar by exerting constant tension on the bar . . . and assures no loose parts. The washer also separates the fibre bar from the copper terminals . . . a spacer to provide better cooling.

Monarch Fuses are fully approved and are available through recognized wholesalers.

Specify Monarch Fuses *for improved* FUSErvice

MONARCH FUSE CO., LTD.
116 E. FIRST ST., JAMESTOWN, N. Y.

characteristics, to improve accuracy and dependability of highspeed switching operations under adverse atmospheric conditions. Western Electric Co.

(44) FLUORESCENT FIXTURES — Two file sheets describe and illustrate 2-lamp 40-watt fluorescent lighting fixtures for (1) stores, offices and schools and (2) industrial applications. Assembly and mounting details are included. Monogram Lighting Units, Inc.

(45) ELECTRONIC SCRIBER — Bulletin C2 presents design, operation and specification data of electric scriber recommended for measuring, indicating, or recording. Wheelco Instrument Co.

(46) VAPOR TIGHT FIXTURES—Catalog folder presents dust and vaportight fluorescent equipment for hazardous locations. The Miller Co.

(47) READY FLUX WELDING RODS — Current issue of the Eutectic Welder is devoted to development and application of ready-flux-coated rods for gas welding designed to insure instantaneous bonding at lowest possible temperatures. Eutectic Welding Alloys Corp.

(48) SHEAVES—Bulletin No. 305, discusses sheaves for V-belt operation, including construction and specification details, dimensions and applications, as well as latest prices. American Gear and Manufacturing Co.

(49) RADIO COMPONENTS—New 52-page catalog describes and illustrates over 2000 radio-electronic components with prices included. Insuline Corporation of America.

(50) INTERCOMMUNICATION—A booklet, "Sound, a Modern Control System", is available containing description of complete line of voice paging and music systems. Executone, Inc.

(51) CATALOG—Complete catalog contains line of electrical wiring devices, lamps and specialties. Eagle Electric Manufacturing Co.

(52) UNDERFLOOR DISTRIBUTION—A 4- page 2-color folder presents advantages, uses, construction and installation of under-floor ducts and auxiliary fittings, inserts and junction boxes. Walker Brothers.

(53) LIGHTING COMBINATION — File sheet describes fluorescent and incandescent fixtures that can be combined for general and spot lighting effects. Monogram Lighting Units, Inc.

(54) WELDING—"Hobart Arc Welding News" is booklet discussing welding methods in various sections of the country. The Hobart Brothers Co.

In the News

Construction Program For Institutions

A $1 billion construction program is now being carried out by 1,376 American institutions of higher learning and they are planning $2.6 billion of additional work, a survey now being completed jointly by the U. S. Office of Education and the Federal Works Agency reveals. This program is somewhat larger than preliminary figures released last May revealed.

The 1,376 colleges and universities, which represent 95 percent of the total enrollment in such schools, report that they now have projects underway providing 43,800,000 sq. ft. of non-housing space and 36,342,000 sq. ft. of residential space. Between now and 1950 these institutions will need a total of 184,690,000 sq. ft. of additional space costing $2.6 billion.

At present the schools reporting have 2,340,000 students, of which 48 percent are veterans. The survey also reveals that by the fall term of 1949, enrollment in the schools will probably reach 2,561,000 and by the fall of 1959, over 2,800,000. These figures compare with the recommendation by the special commission on higher education appointed last year by President Truman that federal aid be provided through scholarships and other means to permit an enrollment of 4,600,000 students in these same schools by 1960. These recommendations were contained in a report released in December and prepared by a committee headed by George F. Zook of the American Council on Education.

Before the war the institutions reporting had sufficient non-housing plan facilities to provide about 175 sq. ft. of floor space per student. Now this figure is approximately 125 sq. ft. and if all of the work now being planned is carried out, the space will have been increased to only about 155 sq. ft.

To determine if the institutions making extensive building plans can adequately finance the work, a sample study of 106 representative institutions in 43 states with a total enrollment of 475,000 students last fall was recently completed. This study showed that these schools had $240,000,000 actually available for their expansion plans and that late in 1947 they have under contract $80,000,000 of work to be financed with this money. These same schools have also been authorized to issue revenue bonds for self-liquidating projects to the amount of $40,000,000. The latter facilities would include dormitories, union buildings, and athletic facilities. From this study, Ernest V. Hollis, chief of the Veterans Education Facilities Program of the U. S. Office of Education has concluded that many institutions are now in a financial position that will permit them to go ahead with construction of much needed projects.

The Bureau of Community Facilities of the FWA late in 1947 reported that it had used several thousand surplus war structures to provide 15,000,000 sq. ft. of floor space for institutions training students under Title II of the Servicemen's Readjustment Act of 1944. This work was done between August 1946 and December of this year under authority by Public Law 697 of the 79th Congress. At first an appropriation of $75,000,000 was provided and to this was added a $5,000,000 balance from the Lanham Act appropriations and later $3,000,000 as a restricted appropriation was made available by the 80th Congress.

All types of structures have been acquired by the bureau. In general, buildings in hospital areas of military installations have been found most satisfactory for removal, and barracks of certain types the most suitable for dismantling for the use of their component materials. In a report dated late in 1947, Commissioner George H. Field of the bureau reported that 5,650 surplus buildings had been assigned for transportation and re-erection and that 1,400 structures had been dismantled for materials.

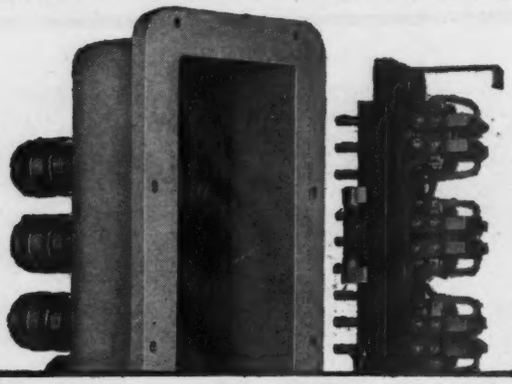
Tug-o-war against two wire connectors is staged by contractors N. A. Bourscheidt, Bourscheidt Electric Co, Peoria, Ill, and Roger Skelton, Skelton Electric Shop, Princeton, Indiana, at recent lighting exposition in Chicago. Waiting for the "break" are R. W. Osborn (left), St. Louis, Mo. contractor and N. L. Neuman and L. J Kelly of the Solar Electric Corp., Warren, Pennsylvania.

Firm Prices Necessary

A firm price and a definite delivery condition in the Electrical Industry is necessary if inflation is to be controlled and building is to continue, Robt. W. McChesney, President of the National Electrical Contractors Association and President of Harry Alexander, Inc., said recently.

The big immediate job at the outset of 1948 is to stop inflation and that can

for...
Complete Protection



Specify
UNILARM

the Unit Alarm System
. . . ready to Install

BULLETIN U-46-4
gives wiring diagrams, dimensions, prices and complete information.
Write for your copy today on your business stationery.

Unilarm combines in one compact unit the many features essential for complete supervision of all types of electrical and mechanical process control.

Saves valuable space, reduces engineering and installation costs to a minimum.

Plug-in panel cuts maintenance and provides continuous alarm protection.

Test switch gives instant proof of Unilarm's readiness to function under alarm conditions.

Flashing alarm signals every departure from a predetermined normal condition.

Available for panel or surface mounting.

EXPLOSION-PROOF . . . . . DUST-TIGHT
VAPORTIGHT . . . . GENERAL PURPOSE

Since 1902

RUSSELL & STOLL COMPANY, INC.
PRECISION BUILT ELECTRICAL EQUIPMENT
125 BARCLAY STREET • NEW YORK 7, N. Y.

51

be done only by action on the part of every one in the industry to bring back and retain a firm price basis of operation.

Following is the text of Mr. McChesney's statement:

Vexing problems confront us at the start of the New Year. They are problems of re-adjustment from war. There is no reason to be awed by them. They can be solved if we apply ourselves to them and work together.

Our big immediate job is to control inflation. The Electrical Industry has an obligation to help in this control and by so doing we have the opportunity to perform a real public service. Each individual or group must contribute to this and not depend on the other fellow to do it.

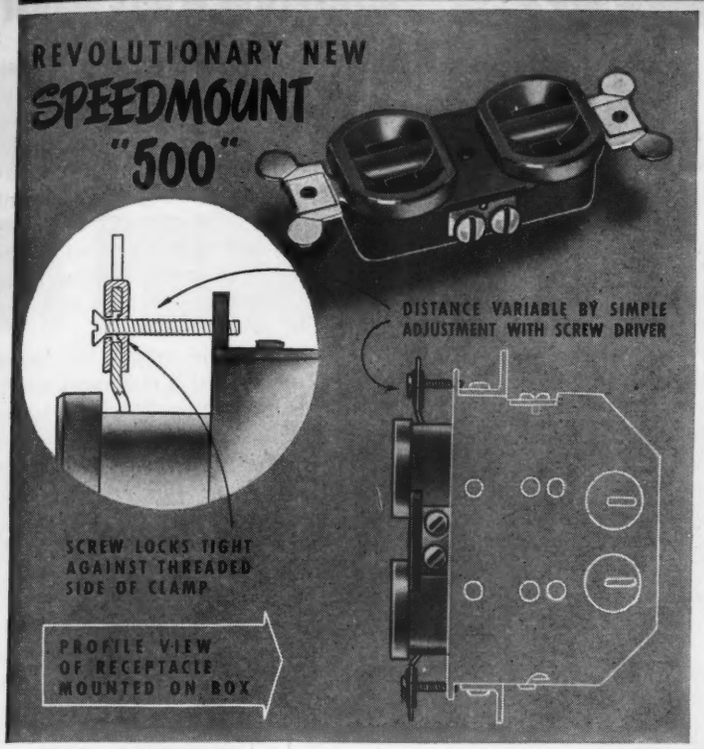
This opportunity and obligation is to maintain a firm price and definite delivery condition in the Industry so that the consumer may know how much he will have to pay and when he will get it. The electrical contractor must insist on this. The suppliers must comply. Unless this condition is brought about and maintained, building will price itself from the market and we will have economic stagnation.

If we have the practical business statesmanship to keep costs down to levels that will stimulate demand, the future of the Electrical Contracting Industry in 1948 and for years to follow seems assured. The backlog is immense but back of the backlog are breathtaking vistas of expanding electrical use.

It is a challenge to Electrical Interdependence. The full exercise of that concept in 1948 is of primary importance to each of us. For our part we must be bolder and more active in our business promotion and we must work together to develop facts to show our importance to the public and to the other interdependent branches of the Electrical Industry.

Contractors Quinten Mahloch and Irven Tegtmeier of Tegtmeier Electric Company, Omaha, Neb., examine fluorescent showcase unit at Chicago lighting show. Mac Bodian (right) Sunbeam Lighting Co., Los Angeles, Calif., supplies the details.

BELL RECEPTACLES AND PLATES


REVOLUTIONARY NEW
SPEEDMOUNT
"500"
DISTANCE VARIABLE BY SIMPLE ADJUSTMENT WITH SCREW DRIVER
SCREW LOCKS TIGHT AGAINST THREADED SIDE OF CLAMP
PROFILE VIEW OF RECEPTACLE MOUNTED ON BOX

Easier, FASTER MOUNTING!

Bell engineers bring you *another* first with their new Speedmount "500" duplex receptacle equipped with adjustable threaded clamps for *fast* and *accurate* flush mounted installations.

THE SPEEDMOUNT "500" PAYS FOR ITSELF!

No more fuss with washers or broken plates—the Speedmount "500", with its ingenious clamps, enables a jiffy-quick installation tailor-made to insure mounting of receptacles flush with wall or baseboard, when outlet boxes are installed too deeply or not lined up properly.

Speedmount "500" will practically pay for itself in the time saved by faster mounting and the elimination of service calls. Available in brown or ivory. Listed as standard by Underwriters' Laboratories, Inc.

MOUNTING DIRECTIONS

1. Drive screws all the way into threaded clamps
2. Set screws against threaded opening in outlet box
3. Back screws off until receptacle is flush with wall
4. Drive screws solidly home

Clamps adjustable for lateral movement

NO-SHOK DUPLEX RECEPTACLES

Engineered to prevent accidents and save lives, this highly acclaimed SAFETY receptacle provides protection for the home and a most vital need of industry.

With its positive snap-back spring action, face is closed tight when plug is withdrawn. Prevents tampering by unsuspecting children—no longer can shock, burns, or death be incurred through insertion of hairpins, wires, scissors, etc., into current carrying terminals. In industry—keeps out metal chips, or wood shavings—prevents entry of dust, dirt, or splashed liquids.

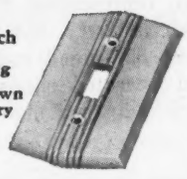
Thick double walls of bakelite separating and insulating heavy duty terminals—lifetime spring action—firmer plug grasp, positive contact always. Large binding screws provide easy wiring. Listed as standard by Underwriters' Laboratories, Inc.

PROMOTE SAFETY

B 1003 Brown
B 1004 Ivory

BELCO WALL PLATES . . .

Belco Duplex Plate
Single Gang
B-1201 Brown
B-1202 Ivory



Belco Switch Plate
Single Gang
B-1203 Brown
B-1204 Ivory

Belco plates combine beauty and simplicity of design with rugged strength. Styled to harmonize with any background, they have instant public appeal. Made of the more expensive plastic—polystyrene, for added lustre, greater strength and pliability. Areas subject to greatest stresses are doubly reinforced to prevent breaking. Available in brown or ivory. Immediate deliveries.

Cat. No.	Color	Rating	Carton	Std. Pkg.	Shp. Wt.	List Price per 100
B 500	Brown	250 V—10 A 125 V—15 A	10 Units	100 Units	16½ lbs.	29.50
B 501	Ivory	250 V—10 A 125 V—15 A	10 Units	100 Units	16½ lbs.	35.00
B 1003	Brown	250 V—10 A 125 V—15 A	25 Units	200 Units	34½ lbs.	45.00
B 1004	Ivory	250 V—10 A 125 V—15 A	25 Units	200 Units	34½ lbs.	53.00
B 1201	Brown	...	25 Units	100 Units	5⅓ lbs.	8.50
B 1202	Ivory	...	25 Units	100 Units	5⅓ lbs.	11.00
B 1203	Brown	...	25 Units	100 Units	6 lbs.	8.50
B 1204	Ivory	...	25 Units	100 Units	6 lbs.	11.00

SPECIFY THE NEW COMPLETELY FOOLPROOF *NO-SHOK* TWIN CONVENIENCE OUTLET

Sold only through recognized electrical wholesalers

Belco PRODUCT
BELL ELECTRIC COMPANY
CHICAGO 8, ILLINOIS

Ceilings Unlimited—

Ivory Bakelite—660W-250V. For 3¼"(Cat. #275-3) and 4" (Cat. #275-4) round boxes. Extra ½" oversize design permits safety margin for installation. Rigid terminals, large binding head screws will take No. 12 copper or No. 10 aluminum wire. Light weight; advantage in shipping and handling. Not subject to mechanical stresses found in porcelain. Minimum breakage. Washer head screws furnished for quick mounting. Listed and Approved by Underwriters' Laboratories, Inc.

Housing programs, both private and government, are assuming the immense proportions long predicted and vitally needed.

Millions of ceiling fixtures will be required now and for the next few years to satisfy this immense market.

Slater's one-piece ivory bakelite keyless lamp holder is another development in wiring-device engineering typical of Slater's foresight in design and engineering.

Electrical contractors will find in its unique features complete justification for specifying this Slater Lifetime product.

Slater
ELECTRIC & MFG. CO.
WOODSIDE, NEW YORK
Lifetime wiring devices

Nisa Opposes Minimum Wage Boost

Opposition to the proposed increase in the legal minimum wage rate (now 40 cents per hour) was recommended by the Public Affairs Committee of the National Industrial Service Association at a recent meeting of the Board of Directors. The report recognized that no one now pays a rate as low as this, but that the economy is suffering from an inflation which it is hoped will not be permanent.

In support of the report, the Board of Directors issued a statement which represents its position. In part, it makes the following specific assertions:

1. The basic philosophy back of the present Wage and Hour Law—spreading the work, limiting output of commodities, regimentation of the worker—is a mistake and the entire law should be repealed.

2. Since repeal of the law is unlikely at this time, it should be improved where possible. Under its administration, the concepts of interstate commerce have been extended far beyond all previous concepts and beyond reason. Congress should amend the law so that businesses which are essentially local service businesses are exempt from application of the law.

3. No code of law can be flexible enough to properly set wages appropriate to the skill and experience of the worker, or the value of his product. Since all costs are primarily labor payments in the long run, it is wrong to freeze into our economic structure the present inflation. The law should not prevent workers from taking jobs, in covered industries, which are in fact worth less than some specific amount.

4. The Association is therefore opposed to any increase in the present statutory minimum wage of 40 cents per hour.

The National Industrial Service Association, representing the electric motor repair industry, has a membership of over 800 small independently owned and operated shops in every State where industrial motors require servicing.

G. W. Haggard Joins REA

Carl Hamilton has resigned as assistant administrator of the Rural Electrification Administration after more than two years' service in that post. He has been replaced by George W. Haggard, who resigned as general manager of the Texas Power Reserve Electric

G-E FIBERDUCT SYSTEM FOR WIRING FLEXIBILITY IN PRINCETON LIBRARY

General Electric Fiberduct underfloor raceways — nonmetallic, noncorrosive underfloor ducts, designed for electrical flexibility — will keep circuits readily available for changes at any time in Princeton University's Harvey S. Firestone Memorial Library, now under construction at Princeton, N. J. Throughout the life of the building, this Fiberduct system will keep it electrically young, by making possible easy and fast changes in its electrical system.

Noncorrosive Fiberduct raceways, laid in the concrete slab, are always available for quick circuit changes and relocation of outlets. In large and small buildings, they cut the expense and time involved in electrical changes by eliminating the necessity for tearing up floors and laying new raceways.

Architects: O'Connor and Kilham, Jr. *Engineers:* Meyer, Strong and Jones. *General Contractors:* Turner Construction Co. *Electrical Contractors:* Ross Electric Construction Co.

A typical double-grid, preset General Electric Fiberduct installation is shown above.

Two double runs of G-E Fiberduct supply the needs of four different wiring systems.

For Flexibility and Economy

In the planning stage of any structure, look into the advantages of General Electric Fiberduct raceways . . . the adaptable underfloor system that permits the installation of new circuits and outlets at low cost, at any time, without ripping up floors.

When new outlets are needed, the Fiberduct raceway can be tapped and a new outlet installed in a matter of minutes.

For advice on using Fiberduct, see your local General Electric underfloor specialist or merchandise distributor.

For general information, write to Section C69-218, General Electric Company, Bridgeport 2, Connecticut

GENERAL ELECTRIC

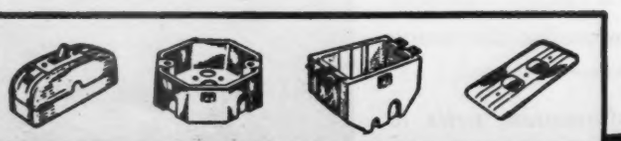
PORCELAIN GETS THE OK

MEET R.E.A. REQUIREMENTS and DO A BETTER JOB on FARM WIRING!

● Safe wiring is a MUST for consumers served under the Rural Electrification Administration! The new R.E.A. "Specifications for Wiring" point the way to safety with approved materials and methods... giving an O.K. to the PORCELAIN way!

Porcelain Outlet Boxes and Porcelain Protected Wiring best serve the requirements of R.E.A., which stipulate that *non-metallic* outlet boxes shall be used with knob and tube and non-metallic sheathed cable wiring.

Whether it's farm or city electrical work — PORCELAIN offers unbeatable time-proven advantages for safe, durable, economical wiring. Ask your Electrical Inspector about non-metallic wiring with Porcelain for safety. Write for wiring manual.



ADEQUATE WIRING SERVES AND SAVES

PORCELAIN PRODUCTS, Inc.
FINDLAY, OHIO

Wire Today for Tomorrow's Load

Cooperative, Inc., to join REA. Both changes were effective January 1.

Mr. Hamilton has returned to his native Iowa to become editor and general manager of the Iowa Falls Citizen. He had been in federal service for nearly 10 years, starting as information staff member for the Agricultural Adjustment Administration.

Mr. Haggard has been general manager of Texas Power Reserve, a federation of 100 REA-financed co-ops, for the past 3½ years. Previously, he was executive secretary of the Texas Farm Bureau Federation.

Name Change For Minnesota Council

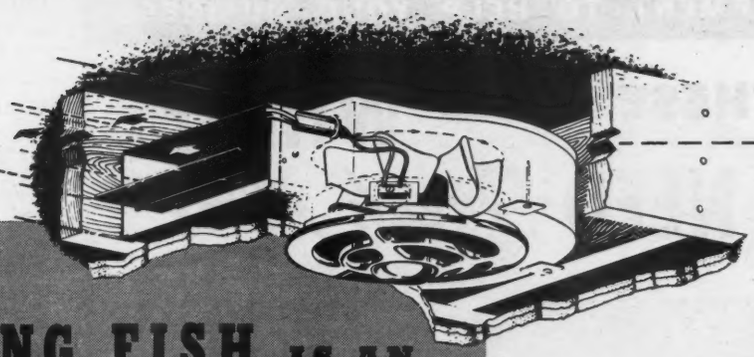
Affiliation of out-of-state groups with the Minnesota Electrical Council, Inc., has led that organization to consider for some time a name change that would more adequately cover the trade area it serves. Recent approval of the Council Board of Directors now makes this move possible.

On and after Feb. 1, 1948, the Council will be known as the *Midwest Electrical Council.* Proposed changes in the Articles of Incorporation were approved by the Directors and submitted to the membership for vote in January.

The name change of the Council does not in any way affect any changes in name or operating methods of the various groups now affiliated with the Council. These include: St. Paul Electrical Contractors Association, Minneapolis Electrical Contractors Association, Minnesota Electrical Association, Inc., North Dakota Electrical Contractors Association, and South Dakota Electrical Contractors Association. Indications point to an early affiliation of the new North West Iowa Electrical Contractors Association with the Council.

Twin-City Groups Elect '48 Slate

Dewey M. Wallin of Northside Electric Co., Minneapolis, was recently elected president of the Minneapolis Electrical Contractors Association. L. E. Lamay, Electric Maintenance Co., was chosen as vice-president and Don Anderson, Parsons Electric Co., secretary-treasurer. New members of the Board of Directors are: A. S. Ingebredtson, Foss Poole, Fred Garling and John Kvalsten. Representing the group on the Minnesota Electrical Council



FRYING FISH IS AN ELECTRICAL CONTRACTOR'S PROBLEM

This one has been tossed right in your lap...And, here's the best way to please Mrs. Housewife ...Eliminate unpleasant cooking odors with

Blo-Fan

ELECTRIC *CEILING* VENTILATION

BLO-FAN ducts out greasy fumes and objectionable odors as they rise...before they spread...because BLO-FAN builds in between the *ceiling* joists directly over the kitchen range—*where a fan belongs.*

Every BLO-FAN installation adds as much profit as 15-20 outlets to your contract, but more than that, it helps to build your reputation for thoughtful, thorough service. Wherever there's a ventilating problem—kitchen, bathroom, game room, laundry—your best solution is **Blo-Fan.**

Blo-Fan

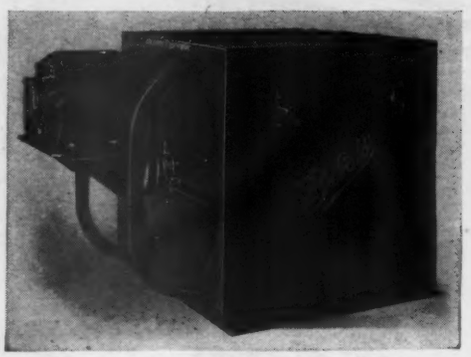
MORE THAN A FAN...MORE THAN A BLOWER

Send a postcard today for complete BLO-FAN information and the names of your nearby BLO-FAN distributors.

PRYNE & CO., INC.
LOS ANGELES 54, CALIFORNIA
NEW YORK · CHICAGO

AIR EQUIPMENT TO HELP YOUR BUSINESS

PUT THESE FANS WHERE YOU NEED *Fresh Air!*



"L" BREEZO FANS

● Here's quiet, economical exhausting of vapors, gases and fumes from hoods and vats — where excess heat or moisture requires a motor away from the air stream. To suit your needs, these units are made in seven sizes — 12″ to 36″ — for capacities up to 7300 cfm at ¼″ static pressure. Complete construction, performance and installation data on request.

BREEZO FANS

Sturdy square panels make installation of these quiet, efficient fans easy! The die-stamped blades are shaped for peak efficiency. Complete range of sizes, from 8″ to 24″. For fans that are easy to sell, easy to install — and that satisfy your customers — specify "Buffalo."

Write for Bulletin 3222-D.

BUFFALO FORGE COMPANY

520 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

EQUIPMENT		FOR
★ VENTILATING		★ FORCED DRAFT
★ HEATING		★ INDUCED DRAFT
★ COMFORT COOLING	★ AIR WASHING	★ PRESSURE BLOWING
★ PROCESS COOLING	★ EXHAUSTING	★ CLEANING
★ AIR TEMPERING	★ BLOWING	★ DRYING

CUTTING COSTS IN EVERY BRANCH OF INDUSTRY

Board are: Jerry Tripp, C. S. Williams and Dewey Walkin.

The St. Paul Electrical Contractors Association re-elected Arthur W. Swanson president of that group. Dave Rosecrans, Rosecrans Electric Co., is vice-president and John Kostka, John Kostka Electric Co., secretary-treasurer. Elected to the Board of Directors were: Paul Schorr, Sr.; Don Kehne; Lawrence Rylander; Leonard Anderson, Mike Paul and Clarence Christensen. Chosen to represent the group as Directors of the Minnesota Electrical Council were: A. W. Swanson, Dave Rosecrans and Edward Hoffmann.

Dates Ahead

Rural Electrical Contractors Association—annual convention, Edgewater Beach Hotel, Chicago, Feb. 9-11.

National Association of Home Builders—Convention and Exposition, Stevens Hotel, Chicago, Feb. 22-26.

Fourth Annual Adequate Wiring Conference—sponsored by the National Adequate Wiring Bureau, Stevens Hotel, uate Wiring Bureau, Stevens Hotel, Chicago, Feb. 26-27.

Electric League of Western Pennsylvania—Commercial and Industrial Sections, Planned Lighting Exposition and Conferences, William Penn Hotel, March 1-4.

North Central Electrical Industries—All-Industry Convention and Trade Show, St. Paul, Minn., February 29-March 4.

National Electrical Manufacturers Association—Winter Convention, Edgewater Beach Hotel, Chicago, Ill., March 14-18.

American Society of Tool Engineers—Sixteenth Annual Meeting, Cleveland, Ohio, March 15-19. Hotel Cleveland.

American Society of Tool Engineers' Sixth Industrial Exposition — Public Auditorium, Cleveland, Ohio, March 15-19.

Chicago Production Conference and Show—sponsored by Chicago Technical Societies Council, Stevens Hotel, Chicago, Mar. 22-24.

National Association of Corrosion Engineers—Fourth annual Conference and Exhibition, Jefferson Hotel, St. Louis, Mo., April 5-8.

Edison Electric Institute—14th Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 6-8.

Electrical Manufacturers Representative Association, Inc. — Annual Electrical Show, Alcazar, Baltimore, Md., April 6-8.

Midwest Power Conference—Tenth annual conference, sponsored by Illinois Institute of Technology, Sheraton Hotel, Chicago, Ill., April 7-9.

San Francisco Real Estate Board and Associated Home Builders of San Francisco, Inc.—Home Show, Civic Auditorium, San Francisco, Calif., April 7-14.

Home Builders Council of New York, New Jersey and Connecticut—Annual Home Show, Grand Central Palace, New York, N. Y., April 17-24.

National Industrial Service Association—Annual convention, Hotel William Penn, Pittsburgh, Pa., April 26-29.

Chamber of Commerce—Annual meeting, Washington, D. C., April 27-29.

National Electrical Wholesalers Association—Annual convention, Statler Hotel, Buffalo, N. Y., May 2-7.

Edison Electric Institute—Annual Engineering meetings, Edgewater Beach Hotel, Chicago, Ill., May 3-5.

Westinghouse Agent Distributors Association—Hotel Statler, Buffalo, N. Y., May 9-11.

National Fire Protection Assn.—Annual meeting, Statler Hotel, Washington, D. C., May 10-13.

Edison Electric Institute—Annual convention, Atlantic City, N. J., June 2-4.

Society of the Plastics Industry—Annual Meeting, Ambassador Hotel, Atlantic City, N. J., May 20-21.

Second International Store Modernization Show—Grand Central Palace, New York, N. Y., July 6-10.

American Institute of Electrical Engineers Fine Arts, Mexico City, Mexico, June —Summer General Meeting, Palace of 21-25.

. . . GIVE BETTER PERFORMANCE WITH LESS MAINTENANCE!

Constructed from Steel and Mica (durable and non-breakable materials), P-G Steel Grid Resistors are truly built to last longer. Designed to efficiently use the space available, the utmost in long and trouble-free service can be expected. Try P-G Steel Grid Resistors next time on your toughest job . . . they are rugged . . . they are dependable.

For further information—Write for BULLETIN No. 500C

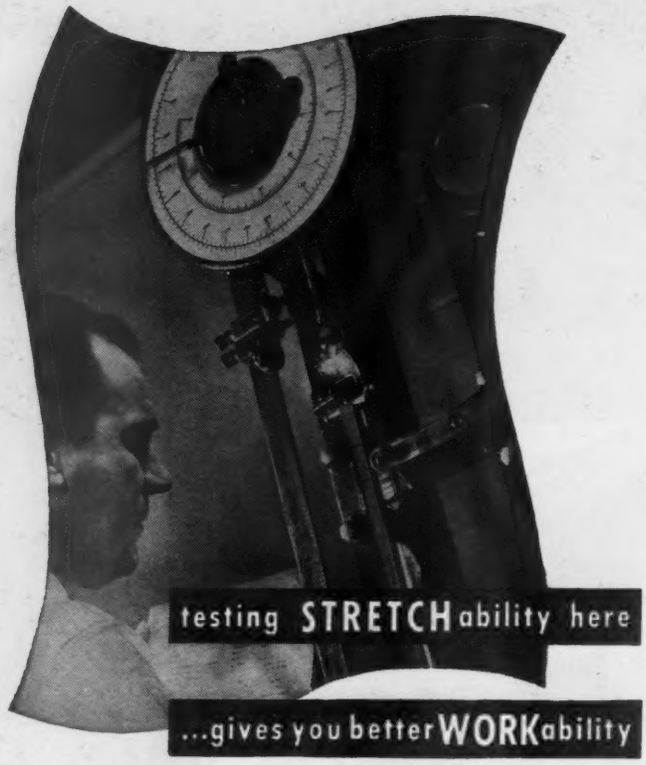
P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO



in PANTHER and DRAGON Rubber Tapes

Testing the tape's stretchability on a Scott tester, as shown here, is only one of a series of quality control tests made during various stages of production that make PANTHER and DRAGON Rubber Tapes "tops in tapes". You can count on these tapes to be strong enough to stretch without breaking . . . make better splices that will last longer.

Made by a company in the insulation business for nearly 70 years, PANTHER and DRAGON Friction and Rubber Tapes pass ASTM and federal specifications for electrical and physical properties with a wide margin of safety. They have proved their worth in successful splicing jobs of all kinds. Sold only through recognized independent wholesalers. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

6173

Panther and Dragon
friction and rubber tapes

International Association of Electrical Inspectors — Western Section, Denver, Colo., September 13-15; Northwestern Section, Salt Lake City, Utah, September 20-22; Southwestern Section, Oakland, Calif., September 27-29; Eastern Section, October 11-13; Southern Section, Heidelberg Hotel, Jackson, Miss., October 18-20.

National Electrical Contractors Association—47th Annual Meeting, Roney Plaza Hotel, Miami, Fla., November 30-December 3.

Illuminating Engineering Society — National Technical Conference, Boston, Mass., September 20-24.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., November 8-13.

Manufacturers News

W. J. FLEMING ELECTED VICE PRESIDENT OF TRUMBULL

The Trumbull Electric Mfg. Co. in Plainville, Conn. has announced the election of William J. Fleming as vice president in charge of engineering. Mr. Fleming has been associated with Trumbull since February 1946 and has been executive engineer of the firm since April 1947. Following his graduation from Pennsylvania State College,

W. J. FLEMING

Mr. Fleming joined the General Electric organization in 1923 as an engineering student. After completing the G-E training course, he was assigned to the control engineering division where he served during the ensuing 23 years as materials handling engineer, administrative assistant and finally, assistant engineer of the division.

GENERAL ELECTRIC APPOINTMENTS

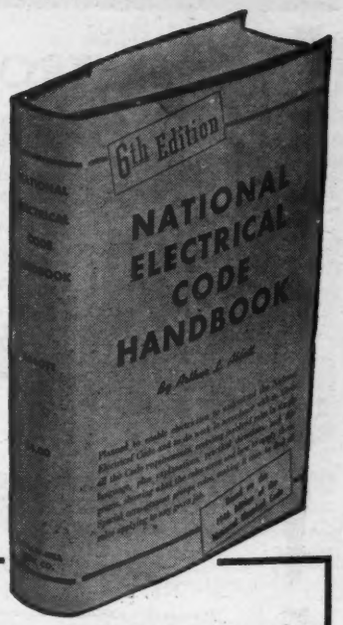
Henry V. Erben has been elected a vice president by the board of directors of the General Electric Co. and becomes general manager of the apparatus department. He succeeds Roy C. Muir, company vice president, who has retired after more than 42 years service.

John D. Lockton has been elected treasurer of the company, succeeding Jesse W. Lewis of New York, who has retired after more than 37 years of service.

Four appointments have been an-

How to handle all kinds of wiring and installation jobs

in strict compliance with the latest National Electrical Code



Here's the "bible" of the electrical field . . . the electrical contractor's essential job-book—the first revision in six years—almost completely re-written in accordance with the new Code requirements—planned to enable you to understand the new rulings of the National Electrical Code and to do every job in accordance with it. It restates involved rules in simple language—it provides explanations, furnishes practical directions and diagrams showing WHAT THE CODE RULES MEAN and HOW to apply them. Gives you finger-tip control . . . enables you to find *all* the rules applying to a specific job within a matter of seconds.

Key to the Code

A few minutes attention to the Key to the Code Requirements in the front of this book will give the reader a better idea of the scope and contents of the Code than could be obtained by two hours' study of the Code itself.

Sixth Edition

National Electrical Code Handbook

By ARTHUR L. ABBOTT

633 pages, 421 illustrations, $4.00

This handbook is one of the most helpful electrical books published. It gives a wealth of information from the practical angle of getting jobs done according to code requirements. It covers every phase of your day-to-day job . . . brings you tested, proven *and approved* wiring techniques covering motors and controllers, generators and transformers, switches, appliances, remote-control systems, cable assemblies, feeders and services, etc. It saves delay in starting jobs . . . it saves time and money in avoiding false starts and violations. At the same time, it contains so much clearly presented information that it will pay you to use it for general reference on many questions of material, plans, wiring, and installation.

All rules for a job grouped in one place

Once you have looked up a rule in this handbook, you may rest assured that you will not find later that there was another rule to be considered and that the job will have to be done over. It reduces a maze of scattered rules to a logical and understandable system.

Based on the 1946 National Electrical Code—
ADOPTED AS THE 1947 CODE

Covers all the new Code revisions, showing you:

—how to reduce wiring costs for electric ranges

—how to protect running motors against overloads, excessive heating, mechanical injury

—how to install infra-red lamps for industrial heating and drying

—how to protect motors driving machine tools, including necessary wiring

—how to install capacitors for power-factor correction

—how to protect transformers against overcurrent

—how to wire in rigid conduit for voltage not exceeding 15,000 volts

—how to shield interior "network" systems

—how to form "stress cones" at cable terminations

—how to install and protect special types of electric welders

Check its coverage of:

approved types of wiring installation requirements applying to all types of wiring
cable assemblies
raceways — requirements applying to all raceways
underplaster extensions
outlet, switch and junction boxes
switches — panelboards — switchboards
electrical appliances
motors—motor controllers
motor wiring and protection
generators — transformers — auto-transformers
capacitors — resistors and reactors—lightning arrestors —storage batteries
grounding
overcurrent protection
design of wiring installations —branch circuits — feeders and services
outside wiring
remote-control, signal and low-energy power systems—communication systems
elevators — cranes and hoists — machine tools
construction of materials, devices, fittings

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Send me Abbott's **NATIONAL ELECTRICAL CODE HANDBOOK** for 10 days' examination on approval. In 10 days I will send $4.00, plus a few cents postage, or return the book postpaid. (Postage paid on cash orders.)

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FULLMAN Latrobe PRODUCTS

FLOOR BOXES · WIRING SPECIALTIES

LATROBE

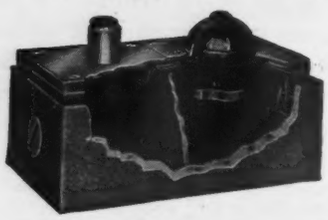
"LATROBE" PRODUCTS ARE TRIED AND TRUE

Year in and year out, electrical contractors specify "Latrobe" when ordering Floor Boxes and Wiring Specialties.

This is the most powerful testimony we can offer as to the economical and efficient performance of "Latrobe" Products.

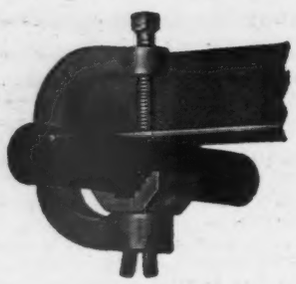
No. 284 Nozzle with No. 200 Cover Plate

Here is the neatest, most compact-fitting Duplex Receptacle Nozzle on the market. Is furnished with ½" or ¾" Brass Pipe Extension.



No. 252-R Floor Box

This dependable Two Gang Adjustable Box has No. 208 Receptacle in one section. One Cover Plate has ½" Flush Brass Plug; the other, 2" Flush Brass Plug.

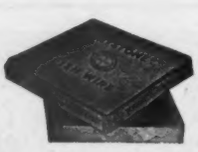


No. 470 "Latrobe" Pipe or Conduit Hanger

Made of highest grade malleable iron, this sturdy hanger is quickly and easily installed and hangs pipe or conduit ½", ¾" and 1" to steel beams ⅝" thick.

No. 110 "Latrobe" Watertight Box

Using 3½" diameter Cover Plate and No. 208 Receptacle, this No. 110 Box is so simple and easy to install that it saves 15 to 20 minutes installation time on each box. Safe and dependable, with plenty of wire space inside box.



Keystone Fish Wire

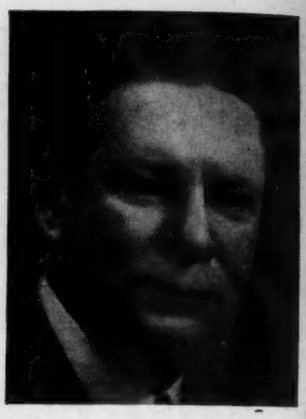
Finest grade flat steel wire, expertly tempered. Comes in ten sizes to suit the lightest work up to the heaviest power wiring.

Sold Only Through Wholesalers

"Bull Dog" Insulator Supports

Safe and sure for fastening porcelain or glass insulators to exposed steel framework. Four sizes 1" to 2½".

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA



H. V. ERBEN

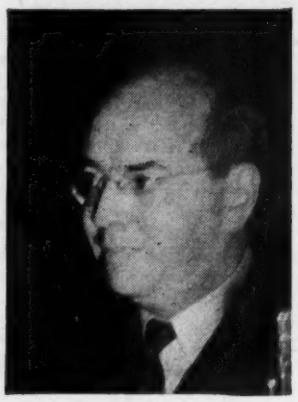
nounced in G-E's control divisions. M. H. Blesh has been named manager of manufacturing, C. B. Bradish, manager of engineering, and E. A. Green, manager of sales. Thomas I. Hage has been named accountant for the divisions.

C. M. Snyder has been appointed manager of the New England Sales District office of the Lamp Department of the General Electric Company. He succeeds C. C. Walker, who was named commercial vice president of the General Electric Company in Boston.

U. S. RUBBER APPOINTMENTS

The Wire and Cable department of United States Rubber Company has announced the appointment of Frederick P. Combier as manager of branch sales.

For many years Mr. Combier was vice president and sales manager of the Fibre Conduit Co. of Orangeburg, N. Y. He has also been vice president and sales manager of Hunter Douglas



F. P. COMBIER

Corp., Circle F. Mfg. Co. and Robeson-Rochester Corp. He was one of the original members of the Hotpoint sales organization, serving as salesman, district sales manager and then managing director of the Canadian company.

In his new position he will have supervision over 29 branches throughout the country distributing wire and cable products and the company's new conductive rubber heating panels.

John S. Krauss, a pioneer developer

FOR BETTER MOTOR BRUSHES

Call OHIO

FOR Specially Designed MOTOR BRUSHES

Call OHIO

FOR INFORMATIVE CATALOGS and MOTOR LISTINGS

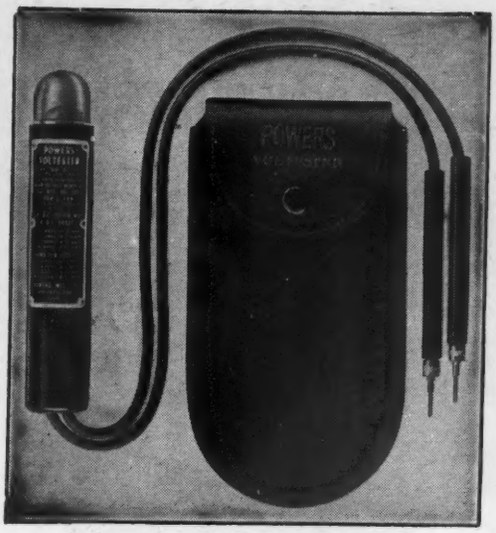
Call OHIO

FOR THE ANSWER TO YOUR MOTOR BRUSH PROBLEMS

Call OHIO

THE OHIO CARBON COMPANY
12508 BEREA ROAD
CLEVELAND 11, OHIO

POWERS VOLTESTER



CATALOG NO. E 112

Is a practical tool for ordinary voltage testing. It is equipped with a six-watt Mazda lamp (not a neon lamp) which will tell you positively at a glance whether the circuit is HOT and HOW HOT.

You should know if you are working on 110-220-440 or 550 volts. A POWERS VOLTESTER tells you definitely. You need no light to read the voltage shown with this tester. It tells you by the brilliancy of its own light what voltage you are on.

If you must know the exact voltage reading use a Volt Meter. But for practical testing use a POWERS VOLTESTER.

Sold Only Through Distributors

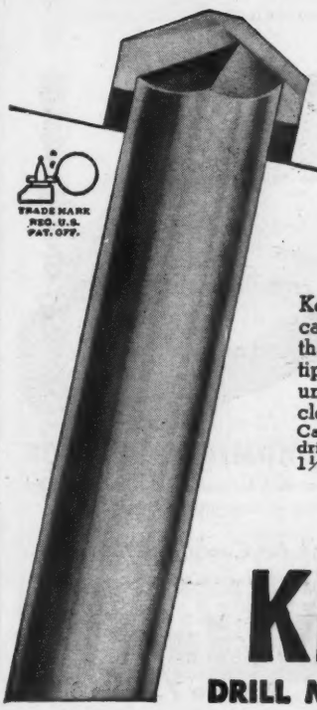
LIST PRICE WITHOUT LEATHER CASE.....5.20

LIST PRICE WITH LEATHER CASE (Attachable to belt).....6.60

MADE BY **POWERS MFG. CO.** 1527 FOLSOM ST. SAN FRANCISCO 3, CAL.

SPEED!

BECAUSE THE CUTTING EDGE is KENNAMETAL



TRADE MARK REG. U.S. PAT. OFF.

Kennadrills have cutting tips of Kennametal cemented carbide—the metal that is far harder and more durable than tool steel. No starting punch needed—Kennametal tip takes hold readily, drills fast, retains sharp edge under heat and abrasion of cutting. Design assures clean, accurate drilling in all types of masonry.

Can be used in any rotary electric drill. Available in sizes for drilling holes: ¼", 5/16", 3/8", 7/16", ½", 9/16", 5/8", ¾", 7/8", 1", 1⅛", 1¼", and 1½".

Distributors Wanted

KENNAMETAL Inc., LATROBE, PA.

KENNADRILLS

DRILL MASONRY FASTER, CHEAPER, EASIER

Especially Designed

FOR

BETTER SCHOOLROOM LIGHTING

THE *New*

WILEY "SEMINAR"

● The new Wiley "Seminar" is designed especially to meet the particular requirements of planned schoolroom lighting.

The "Seminar" contains two 40-watt fluorescent lamps with starter or instant start certified HPF ballasts. It may be suspended or flush-to-ceiling, mounted singly or in continuous runs, to suit the architectural plan and light output requirements of individual classrooms.

The "Seminar" is a handsome fixture with POLY-LITE (Sandee) Side Panels that provides widespread down-light with uniform ceiling illumination. There are no curved or slanting sides to trap light or collect dust and dirt.

Attractively Priced—
Low Installation Cost—
Economical Maintenance

QUICK-ECONOMICAL SERVICE

The Wiley Seminar may be quickly dusted, cleaned and lamps replaced by one man without tools.

See Page M184 of the IES Lighting Handbook for Complete Data, on full line Wiley Commercial and Industrial Fixtures.

R. & W. WILEY, INC.

Dearborn at Bridge St. Buffalo 7, New York

of the V-belt industry, has retired as manager of the L. H. Gilmer division of U. S. Rubber Co., Philadelphia, after 35 years of service. He will be succeeded by Laurence K. Youse, former technical superintendent of the V-belt plant and recently assistant manager.

J. J. MULLEN, JR. NAMED PRESIDENT OF MOLONEY

James J. Mullen, Jr., executive vice president of Moloney Electric Co., St. Louis, Mo. has recently been named

J. J. MULLEN, JR.

president, succeeding the late James J. Mullen, Sr.

He became affiliated with the Moloney Company in 1933 as secretary of the corporation. Three years later he became executive vice president devoting most of his time to sales and sales promotion.

J. F. GETZ NAMED SALES MANAGER OF I-T-E

The I-T-E Circuit Breaker Company of Philadelphia has announced the appointment of J. Fred Getz to the position of sales manager of the company with complete control over the sale of switchgear products.

Mr. Getz has been with I-T-E since 1944, serving in the various positions of manager, Washington, D. C. office;

J. F. GETZ

To be Sure..

SPECIFY AND USE

SWITCHES BY P&S

WHETHER YOU USE . . .

P&S 1815-D (for one-to-a-gang installations)

OR P&S 1311 (for combination wiring)

YOU GET THESE IMPORTANT FEATURES:

Totally enclosed bakelite body.

Simple yoke oscillating in circular bearings to minimize friction.

Kick-off that assures positive mechanism performance.

Full size, one-piece handle with plainly visible T-rating.

Bakelite cover securely anchored to body in four places.

Switch blade assembly which includes positive aligning guides, functioning also as arc suppressors.

Binding screws capable of handling No. 10 wire.

Send for P&S Catalog for complete listings of P&S switches.

PASS & SEYMOUR, INC.
SYRACUSE 9, N. Y.

Bend Conduit Cold-

Here's How

Conduit can be bent

40°

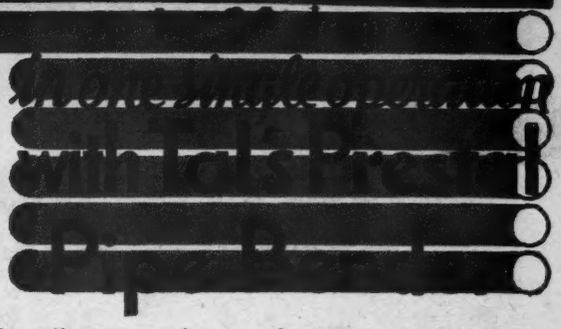
to any desired angle

60°

without moving pipe

90°

in one operation



Installation work goes faster, easier, and at a lower cost when you have a Tal's Prestal Bender on the job. This efficient, light, portable machine handles all pipe and conduit up to 3". Makes perfect bends, up to 90°, cold, in one single operation. No need to waste labor by replacing the pipe three to six times to make a bend. Does a good workmanlike job — smooth, uniform bends without kinks or wrinkles. Simple and easy to operate. Thousands are in successful use everywhere. Write for data bulletin.

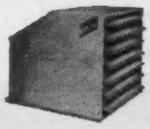
Tal Bender, Inc.

Dept. EC-2, Milwaukee 2, Wisconsin

CHELSEA FANS & BLOWERS

BB–ALL PURPOSE
12" to 30"
1200 to 7000 CFM

OPJ–OCTOPUS JR.
3-4" Hoses
CFM Per Hose
10' = 412 50' = 297



PH—PENTHOUSE
24" to 48"
5700 to 21500 CFM

—for every ventilating requirement in

FACTORIES, SHOPS, OFFICES, SCHOOLS, INSTITUTIONS, etc.

CHELSEA fans, blowers and exhausters move large volumes of air quickly, quietly and efficiently—your guarantee of peak efficiency from workers, key personnel and staff. The complete CHELSEA line includes everything from heavy industrial types, to pedestal fans for spot air circulation. Keep everyone alert, keen,—"on their toes". Install CHELSEA ventilating equipment—NOW!

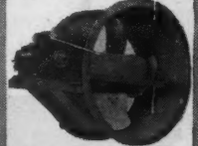
Literature describing the CHELSEA line will be sent promptly on request without obligation.

Address Inquiries to Dept. EC.

INSIST ON CERTIFIED RATINGS! Air delivery ratings of all CHELSEA products are determined by the test method prescribed by the PROPELLER FAN MANUFACTURERS ASSOCIATION and the American Society of Heating and Ventilating Engineers.

CP— BLOWER
3 Sizes
650 to 1020 CFM

IND–INDUSTRIAL
24" to 60"
5700 to 32000 CFM



DXB—BOOSTER
16" to 36"
2000 to 9500 CFM

CHELSEA FAN & BLOWER CO., INC.
1200 GROVE STREET IRVINGTON 11 NEW JERSEY

WHERE THERE'S A TIME SWITCH NEED . . . .

There's an

INTER-MATIC

Sale and Installation for you

$10.00 LIST

America's GREATEST TIME SWITCH VALUE

THESE ARE THE FEATURES THAT MAKE IT PREFERRED

- Easy to install and operate
- Rugged construction
- 35 amperes at 120 volts
- Accurate, reliable
- Fully guaranteed
- Underwriters' Approved

Establish yourself among your customers as an expert on the selection of Time Switches. Standardize on INTER-MATIC —the Time Switch that will back up your judgment with the kind of performance users want. Send in the coupon today for FREE sales helps, catalog and name of your nearest distributor.

INTERNATIONAL REGISTER COMPANY
Dep't. T-18B, 2624 W. Washington Blvd.
Chicago 12, Illinois

COUPON

INTERNATIONAL REGISTER COMPANY
Dep't. T-18B—2624 W. Washington Blvd., Chicago 12, Illinois
Please send FREE sales helps, catalog and name of nearest distributor.

Company.....
Your name.....Address.....
City.....Zone.....State.....

manager, switchgear sales in the home office; and lately, assistant to the president. Before joining I-T-E, Mr. Getz was a member of the General Electric Company for eight years. From 1943 to 1944 he was sales manager of the Roller-Smith Company in Bethlehem.

H. WARD ZIMMER APPOINTED VICE PRESIDENT OF SYLVANIA

H. Ward Zimmer, former vice president in charge of the Radio Tube Division, Sylvania Electric Products Inc., has been appointed vice president in

H. W. ZIMMER

charge of manufacturing operations for all company divisions.

He joined the executive staff of the company in 1919 as purchasing agent and served as general manager of the Radio Tube Division during the war.

E. A. NICKEL APPOINTED SALES MANAGER OF KAHN MFG.

The Kahn Manufacturing Co., Inc. of Milwaukee, announces the appointment of Edwin A. Nickel as general sales manager.

For the past seven years Mr. Nickel has been sales manager in charge of advertising and promotion for the Mitchell Manufacturing Company of Chicago. He has also been with Sylvania Electric Products Co., Dictograph

E. A. NICKEL

What you can do with KONDU:

1 **CHANGE BOXES** without disturbing CONDUIT!

2 **CUT the WEIGHT** of Conduit Lines or Portable Equipment. Kondu Fittings are ALUMINUM alloy.

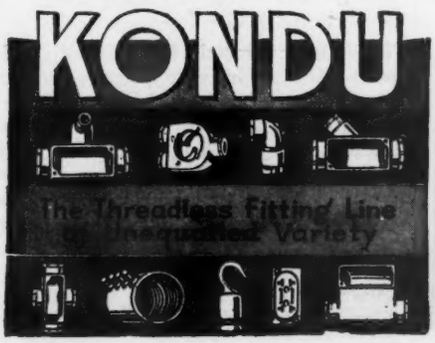
3

Use the RIGHT fitting

Only with Kondu can you take one fitting out of the line and put in another, without disturbing conduit . . . **Two-thirds Less Weight**—More Strength; Kondu fittings are high-aluminum Konduloy, permanently corrosion resistant . . . And the unequaled variety of the Kondu line makes it possible to use a fitting that's ***exactly suited*** to your need. Write for the Kondu Catalog.

KONDU CORPORATION
Erie, Pa.

KONDU MFG. CO. LTD., Preston, Ontario



ELECTRICITY

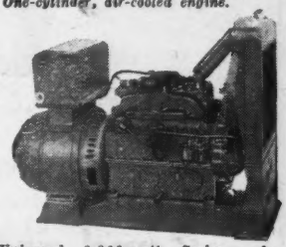
WHERE YOU NEED IT . . . WHEN YOU NEED IT with a Universal "MATCHED UNIT" ELECTRIC PLANT

Universal 2,000-watt Models — for lighting, powering tools, radio, etc. One-cylinder, air-cooled engine.

For dependable electric power—anywhere, any time—choose a Universal. In this most complete line are models—AC or DC, air-cooled or water-cooled engine powered, portable, standby or stationary—for any purpose. Sizes from 250 to 25,000 watts with all types of controls—manual to fully automatic.

Universal Electric Plants are of "Matched Unit" construction—with generator, engine, etc., matched exactly to the other. This assures smooth, low-cost, long-time service.

SEND FOR FOLDER, "ELECTRICITY AT LOW COST!" Gives Full Story of Universal Design—Shows 16 Different Models.



Universal 6,000-watt Series — for medium power requirements. Four-cylinder water-cooled engine. Other models, one to six cylinders, 250 to 25,000 KW.

Contractors and Representatives. Write for details on the profitable Universal franchise.

UNIVERSAL MOTOR COMPANY
FOUNDED 1898
438 UNIVERSAL DRIVE · OSHKOSH, WISCONSIN

Couch Fire Alarm Equipment is *always* ready for action . . . ready to warn personnel of impending danger . . . to summon help for saving lives and property . . . to avert disaster.

Built to stand the test of time . . . quick in its response when urgent need calls it into action, Couch equipment is a reliable, silent guardian of life and property. With Couch equipment on the job, you get *action* . . . and you get it FAST, when you need it.

Send for Illustrated Catalog

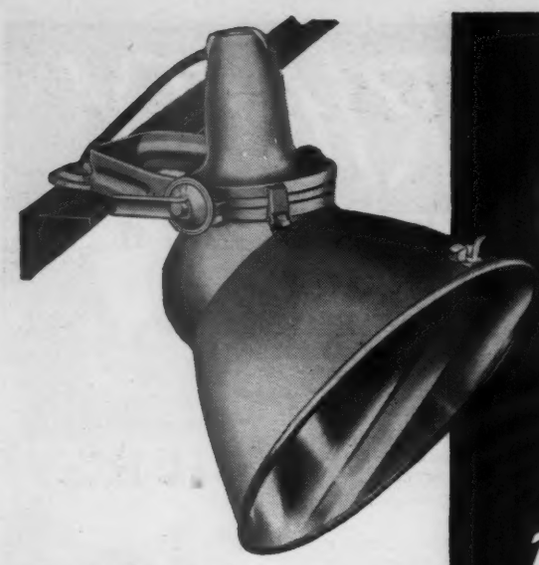
Just ask your secretary to type your name and title on this coupon, clip it to your company letterhead and mail to S. H. Couch Company, Inc., North Quincy 71, Massachusetts. A copy of Couch's Fire Alarm Catalog will be forwarded for your special use without obligation.

NAME_____

TITLE_____

S. H. COUCH COMPANY, INC.
Dept. 802 NORTH QUINCY 71, MASS.

PRIVATE TELEPHONES for HOME and OFFICE . . . HOSPITAL SIGNALING SYSTEMS . . . APARTMENT HOUSE TELEPHONES and MAILBOXES . . . FIRE ALARM SYSTEMS for INDUSTRIAL PLANTS and PUBLIC BUILDINGS.



Type L-69, sports and area floodlight

Call GE for FLOODLIGHTS

. . . and get these important advantages

★ Proper types and sizes for all applications

★ High-efficiency, the result of scientific design

★ Long life and low maintenance expense

★ obtained through sturdy construction

★ Expert assistance with application problems, backed up by 30 years' experience

★ Convenient sales and service facilities

WANT THESE HANDY DESCRIPTIVE LEAFLETS FOR YOUR PROPOSALS?

FLOODLIGHT	PUBLICATION
Heavy-duty, steel casing	
200 or 250 watts, Type L-29	GEA-4303
300 or 500 watts, Type L-30	GEA-4304
750 or 1000 watts, Type L-31	GEA-4305
Heavy-duty, cast aluminum	
1000/1500 watts, Type L-34	GEA-4517
200 or 250 watts, Type L-38	GEA-4325
General purpose, sheet aluminum	
300 or 500 watts, Type L-49	GEA-4311
750 or 1000 watts, Type L-43	GEA-4310
Sports and area, sheet aluminum	
750 to 1500 watts, Type L-68	GEA-4333
750 to 1500 watts, Type L-69	GEA-4590
Area, open porcelain enamel	
300 to 1500 watts Type L-45	GEA-4433
300 to 1500 watts Type L-46	GEA-4434
Handy, sheet aluminum	
100/150 watts, Type L-65	GEA-4516
200 watts, Type L-66	GEA-4346
Underwater, cast bronze	
100/250/400 watts, Type L-33	GEA-4438
500/1000 watts, Type L-39	GEA-4518
500/1000/1500 watts, Type L-41	GEA-4439

Order individually by number, or in sets, from the G-E Apparatus Sales Office or Agent that serves you. Or write General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

Products Co., and the Lennen & Mitchell advertising agency in New York.

Mr. Nickel will maintain an office at the Kahn factory in Milwaukee as well as in Chicago.

R. B. WILKINSON WILL BE GRAYBAR TREASURER

The election of R. B. Wilkinson as treasurer of Graybar Electric Company has been announced. It is to become effective March 1, when E. W. Shepard, who has been Graybar's treasurer since 1926, retires on a service pension. Mr. Wilkinson has been assistant treasurer at Graybar headquarters in New York since June 1946.

•

The merger of Robertshaw Thermostat Company of Youngwood, Pa., The Fulton Sylphon Company, of Knoxville, Tenn. and the Bridgeport Thermostat Company, Inc. of Bridgeport, Conn. under the name of **Robertshaw-Fulton Controls Company** was announced recently by John A. Robertshaw, president of the new organization.

J. V. Giesler, president of the Fulton Sylphon Company and Bridgeport Thermostat Company at the time of the merger, was elected executive vice president of the new firm, in charge of the Fulton Sylphon Division, Knoxville, Tenn. and Bridgeport Thermostat Division, Bridgeport. T. T. Arden was elected executive vice president in charge of the Grayson Controls Division, Lynwood, Calif.

•

The **O. Z. Electrical Manufacturing Co.**, Brooklyn, N. Y. has announced the opening of its new Chicago office at 20 North Wacker Drive. The new office is in charge of George Muenow, formerly in the Dayton, Ohio, sales office of Harvey Hubbell, Inc.

•

The appointment of William C. Madsen as branch manager of the Gary, Indiana office of the **Reliance Electric & Engineering Co.**, has been announced. He succeeds H. J. Thompson who will become district sales representative in Gary for the electrical manufacturing division of the National Acme Co.

•

The **Kubec Electric Co.**, 630 W. Jackson Blvd., Chicago, has been purchased by Frank L. Jaske and Fred A. Girten, salesmen who recently resigned from the Englewood Electrical Supply Co. The company was founded by the late August Kubec in 1915 and has been operated by his executors since his death in July of last year. The present organization will be kept intact by the new owners, who contemplate no changes in personnel.

Muscle Power Wastes Man Power!

You can use your own hand tools on the OSTER No. 422 Power Vise Stand

Let the ½ H.P. motor concealed in the case of the Oster Power Vise Stand take over the muscle-tiring job of threading, cutting, and reaming pipe. This modern machine quickly pays for itself in time saved compared with hand work. Standard range is ⅛" to 2" pipe. When the Oster Power Vise Stand is equipped with the special, universal drive shaft, pipe up to 6" can be cut and threaded in record time and with no effort. Send for Catalog "LIST NO. 22-A".

THE OSTER MANUFACTURING CO.
2081 EAST 61st STREET
CLEVELAND 3, OHIO, U. S. A.

FAST — ECONOMICAL

Drilling — Cutting and Chipping in Concrete and Masonry

with

SYNTRON

DEPENDABLE

ELECTRIC HAMMERS

Electromagnetic design—no motors, gears, cams, eccentrics. Only One Working Part —the Piston.

3600 powerful blows per minute from one working part — the piston — speed up the drilling of anchor bolt holes, cutting, chipping and channelling for conduit.

Operate from ordinary 110 volt AC lighting current.

They'll save you TIME and MONEY every job you use them. —And who isn't interested in that today?

Write for illustrated folder

SYNTRON CO., 690 Lexington, Homer City, Pa.

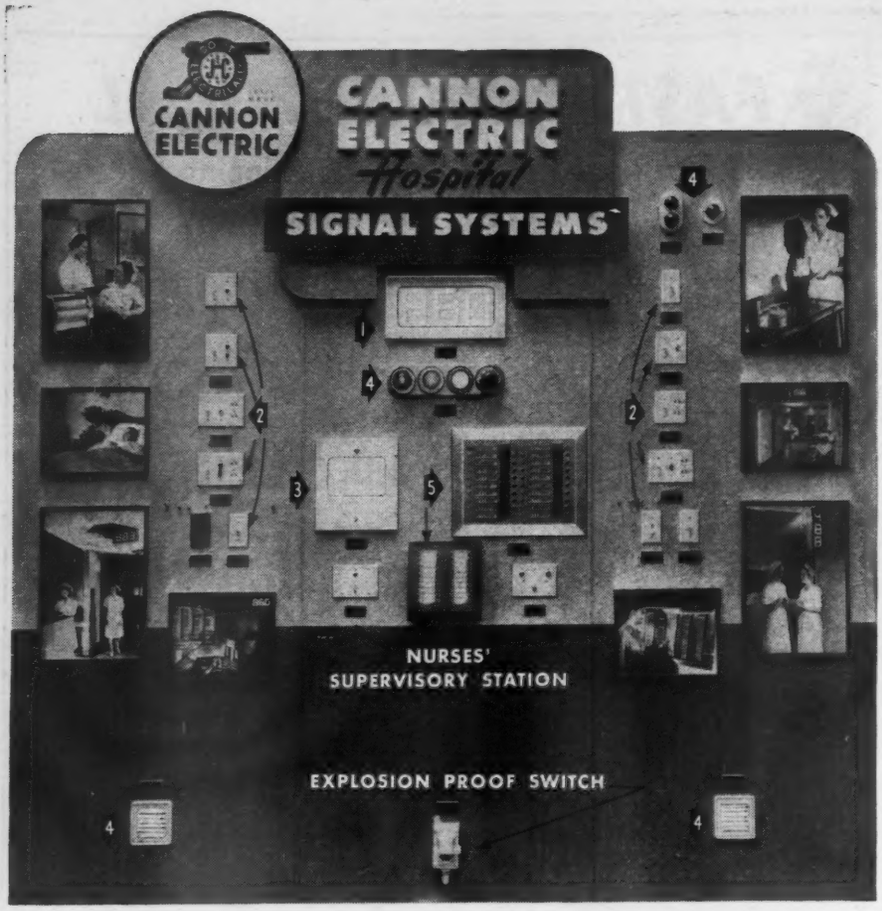
SALI INSULATING BUSHINGS for LONG, HARD SERVICE

- Insure against power failures
- Eliminate grounds and shorts
- Meet requirements of 1947 Code
- Accurately machined —not molded
- Strong, tough, resilient
- Complete range of sizes
- All types—male, female, threadless

THE ADALET MANUFACTURING CO.

If you are not already using SALI Bushings, ask for free sample.

14300 LORAIN AVE.
CLEVELAND 11, OHIO



COMPLETE SIGNAL SYSTEMS
for COMMERCIAL and HOSPITAL USE

1 SILENT PAGING SYSTEMS
with dial control pages 2 to 4 names simultaneously, quietly, silently. Dialing control panel not shown in above display.

2 BEDSIDE CALLING STATIONS
pull cord type shown above. New locking pushbutton available in 1948. Eight basic styles of calling stations to meet all needs of private room and ward.

3 VISUAL ANNUNCIATORS
for quiet paging in factories, hospitals, etc. with 6 to 100 lights. Equipped with intermittent soft tone buzzer, which may be cut off with switch.

4 CORRIDOR, DOOR & AISLE LIGHTS
of various types for a variety of uses. Standard bayonet-type automobile lamps, used in red, green, blue, amber, opal, etc.

5 IN-AND-OUT REGISTERS
with 10 to 100 names: manual type, single face, illuminated, double face, single pole and 3-way switches. Also remote control; message slots. For hospital staff doctors, commercial offices, institutions, etc.

Contact our representatives in principal cities or write for Signal Systems literature. . . Address Department B-231.

CANNON ELECTRIC
CANNON ELECTRIC DEVELOPMENT COMPANY
3209 Humboldt Street, Los Angeles 31, California
Canada & British Empire — Cannon Electric Co., Ltd., Toronto, Ontario • World Export Agents (excepting British Empire) Frazar & Hansen, 301 Clay St., San Francisco 11, Calif.

Jay Tagg has been assigned to the Seattle sales office of the **National Electric Products Corp.**, Pittsburgh, Pa. He will assist N. L. Bost, who represents National Electric in the Pacific Northwest.

•

The appointment of G. R. Clover as sales representative was recently announced by the **Frink Corporation**, Long Island City, N. Y. Mr. Clover's headquarters are at 629 New Center Building, Detroit, Michigan.

•

E. J. Theobald, Jr., H. L. Theobald and E. B. Theobald have incorporated under the name of **Theobald Electric Supply Company**, 630 South Twelfth Street, Louisville 3, Ky. They are a wholesale company carrying a complete line of electrical supplies, commercial and industrial lighting fixtures.

•

John A. Roebling's Sons Company, Trenton, N. J. announces the appointment of L. H. Van Dike, Jr. as Detroit, Michigan, representative, replacing the late Harry T. Hirbe.

•

George J. Taylor, until recently a practicing consulting engineer, has joined the **Day-Brite Lighting** organization as supervisory sales engineer with headquarters in New York City at 92 Liberty Street.

•

General Day-Lite Company have combined the executive offices with the warehouse at 3749 Island Road, Philadelphia, Pa.

•

Anthony J. Yusk has recently taken over the responsibilities of the switchgear sales for the **Electric Power Equipment Corporation.**

•

E. T. Cuddeback, for the last year sales representative in the **Allis-Chalmers** Atlanta district office, has been named manager of the company's Tampa district office.

•

Harry D. Hain has resigned as general manager of La Salle Lighting Products, Inc. to enter sales consultant work. Mr. Hain was appointed general manager of La Salle in 1936, when he resigned as sales manager of the Railey Corp. of Cleveland.

•

T. J. Cope, Inc. has purchased a modern plant at 711 South 50th Street, Philadelphia, Pa.

R for Planned Lighting

Dustproof!

● And so are the close-fitting attachments on enclosed types of LIGHT-IN-LINE Commercial Fluorescent Fixtures. ALL the dustproof and dust-free styles *save you money on maintenance!* Find out why.

This carefully engineered line is available in open, louvered, and glass-or-plastic enclosed types for offices, stores, schools. 2-light and 4-light; 40-watt and 100-watt (which may be combined in *same* line for area intensification). Union made. U/L approved.

WRITE TODAY FOR DETAILS

Get complete information and revealing Electrical Testing Laboratory data sheets NOW. MOE-BRIDGES CORP., Department 702, Sheboygan, Wisconsin.

MOE-BRIDGES
LIGHT-IN-LINE

SERVICE STATION - SPORTS - AIRPORT - INDUSTRIAL & MARINE LIGHTING EQUIPMENT

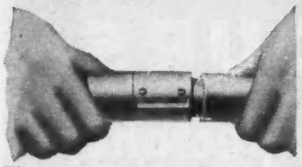
750
1000
1500
Watt Enclosed Flood

Famous Revere Hinged Floodlight Pole

REVERE ELECTRIC MFG. CO.

6017 BROADWAY CHICAGO 40, ILL.

Simply slide DOSSERT BOLTLESS Connector into an end of tubular bus.



Then silde end of other bus over connector up to shoulder of connector.

Only several hammer blows on the key. Lock by screwing in set screws with pointed end of same key.

Connection is complete, streamlined, and secure. (Disassembled just as quickly).

Dossert BOLTLESS CONNECTORS

Patent No. 2198964

FOR CONNECTING TUBULAR BUSES QUICKLY, ECONOMICALLY.

●

Installed in a jiffy . . . supplied as a single unit, already for complete installation.

A new, unique type of bolt connector. Eliminates time-wasting tightening and taping of old-style clamp connectors. Provide permanent, vibration-proof grip. High conductivity copper alloy construction. Available in all types of fittings, such as: couplers, reducing couplers, T connectors, elbows, and in various corresponding combinations of tubular bus and cable.

Particulars on request to Dept. 2

DOSSERT MFG. CORP.
249-255 HURON STREET, BROOKLYN 22, N. Y.
SINCE 1904

WHATEVER YOU CALL AN INSULATION TESTER

THE NEW

MODEL B-7 MEGOHMER

IS TOPS

COMBINED PRECISION OHMMETER & MEGOHMMETER
0-20, 0-200 MEGOHMS. 0-200, 0-20,000 OHMS.

Reads as low as 1/10 of 1 Ohm to as high as 200 Megohms. 2 Test Potentials 250/500 Volts. No cranking, no wavering of pointer. Saves time and effort. Simplifies Insulation Testing. Ideal for low resistance testing too.

WRITE FOR NEW BULLETIN 440

HERMAN H. Sticht COMPANY, INC.
21 PARK PLACE NEW YORK 7, N. Y.

COMPLETE STOCKS WESTINGHOUSE! WAGNER! DELCO!

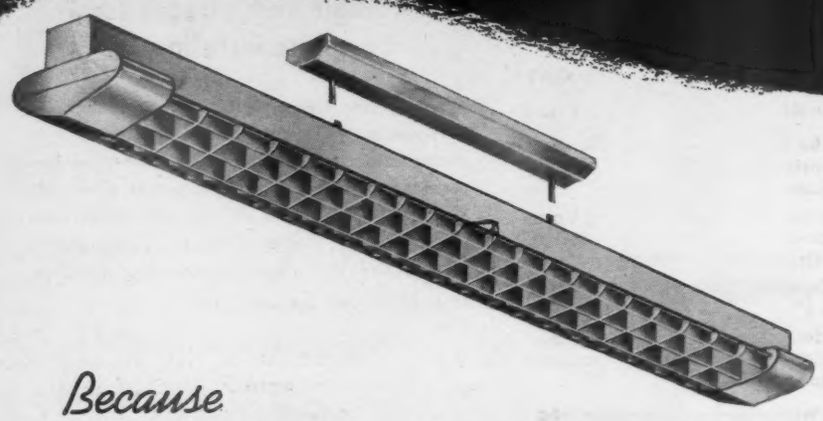
Electric Motor Parts

Send for Your Catalog On Your Letterhead Today to . . .

The HARRY ALTER Co.

1728 S. Michigan Ave. Chicago, Ill.
134 La Fayette St. New York, N.Y.

Sell COLOVOLT 10,000 HOURS Lamp Life Expectancy



Because they give complete customer satisfaction with your job—both now and later. 10,000 hours lamp life expectancy means lower maintenance cost—lack of intermediate burn-outs—no replacing lamps during working hours. Complete absence of flicking; practically no deterioration throughout the entire life of the tube.

Because they give an even, glare-free light that is soothing and pleasing. No spots of greater or lesser brilliance—no flicker; no stroboscopic or vibrating effect. COLOVOLT lamps start instantly, have a low surface brightness because the lumens are distributed over a longer area, give true color discrimination and lend themselves to all interior treatments.

Because they are easy to install—operate on low voltage cold cathode ballasts or high voltage transformers and do not require special wiring or starters.

COLOVOLT Lighting Fixtures are modern in design and appearance—are easily maintained and cleaned—have less dust collecting areas—may be used with different types of diffusing glass or louvres—are all steel with an exceptionally durable baked enamel finish which retains a hard, smooth, even surface. Union made and Underwriters' approved.

The trend is to Cold Cathode Lighting. Write or wire today for complete information.

General LUMINESCENT CORPORATION

*Trade Mark Reg. U.S. Pat. Off.

GENERAL LUMINESCENT CORPORATION

672 SOUTH FEDERAL STREET • CHICAGO 5, ILLINOIS

SPECIAL SERVICES FOR SPECIALIZED OPERATION

[FROM PAGE 67]

parts of the building occupied by telephone equipment, only. It is just as necessary to keep the equipment under uniform temperature as it is to artificially cool or warm the air in the offices. A large load of electrical energy is absorbed in the operation of a telephone exchange. Relays and resistance coils of all kinds, thousands of them, are more or less continually in operation, dissipating energy in the form of heat, to raise the temperature of the rooms. In warm weather, especially, this air must be drawn off and replaced by cooler air.

Uniform Temperatures

In general, throughout the building, the air is kept at uniform temperature by artificially heating or cooling it as the conditions demand. Air is drawn in from the roof to the basement, filtered (eventually under electronic control) and blown up a common duct to all floors.

At each floor, this filtered air is drawn from the common duct by motor-driven fans, there being four to each floor. Coils in the fan ducts at each floor receive refrigeration from the 125 ton capacity ice plant located in the basement, or else receive heat from low-pressure steam boilers also located in the basement, either cooling or warming the air as the conditions demand. In this climate the ventilating and cooling cycle is used a large part of the time.

Temperature Control

The plant as a whole is automatic in operation. There are four to seven zones on each floor, the temperature in each zone controlled by a separate thermostat. Low voltage circuits were run for each floor separately, to a control board on each floor. It was the electrical contractors job to provide the conduit runs for the low voltage circuits, to install the motors for the fans on each floor and also to install the fan motors for the system located in the basement.

The electrical contractor on all this work is the R. R. Jones Electric Co., Pasadena, California, and the consulting engineers the E-L-E Company, Los Angeles.

PIERCE

Amazing

SCIENTIFICALLY DESIGNED

FUSE LINK

Keeps

EQUIPMENT OPERATING

during safe loads

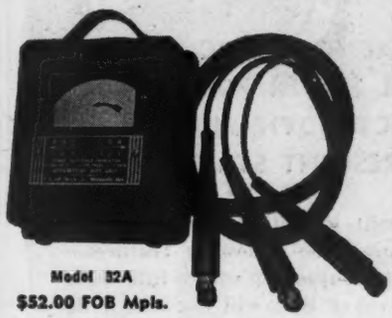
(100% to 200%)

Blow points are accurately computed. Extra surface area carries away heat. Ruggedly built tubular bridge and screen ventilated case contributes to its efficiency and lasting good value.

FREE: Balanced Lag Link to inspect and test. Specify amperage, voltage.

QUICK POSITIVE READINGS

with the new **"SELCO"**



Model 32A
$52.00 FOB Mpls.

PHASE ROTATION INDICATOR

50 to 600 volt, 25 to 400 cycles, 2, 3, or 6 phase

- The SELCO Indicator gives you quick positive readings. Avoids costly mistakes.
- Indicates immediately phase sequency by numerical, alphabetical color coding, and CW-CCW methods.
- Compact and lightweight. Only 5½" x 6" x 3". Weight 3½ lbs.
- Ideal for utilities, contractors, industrial plants, electrical manufacturers, and others.

WRITE FOR FREE FOLDER TODAY

H. H. Sell Electric Co.
1903 Willow Ave. No.
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Stock Models from 1100 to 4950 Watts per pole.

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SKYSCRAPER DISTRIBUTION

[FROM PAGE 75]

meters mounted adjacent to the main switchboard.

Direct radiation during the winter is regulated by a Dunham system. Controls, located near window surfaces to accurately measure heat losses, activate steam valves in accordance with the humiture.

While the largest motors are the refrigeration compressors, the total power load is materially increased by many exhaust fans, elevators and pumps (sump, house, vacuum return, high pressure drip, fire, condensate and cold water) located throughout the structure. The extent of motorization is indicated by a listing of motorized equipment which even includes such items as pushbutton motorized awnings over the Plaza entrances and a motorized blackboard in the mezzanine-level auditorium which descends from the ceiling when desired for illustrating purposes.

All electrical equipment in the building can be controlled from a central alarm board in the sub basement, although local switches are also installed at all points of motor installation and application. On the alarm board, each remote controlling pushbutton ON-OFF set is coupled with an indicating red light which remains on whenever the related motor is in operation.

Electrical distribution is primarily cable-conduit with a limited amount of busbar installation for establishing direct connections between the power section of the switchboard and the larger motors, such as compressors. Underfloor duct is used throughout the large open floor areas, such as in the banking section, to carry wiring for alarms, telephones and floor receptacles. Separate distribution systems are installed for power, lighting, fire alarm control, the 100-station building service intercommunication telephone system, public telephones, Western Union service and heat control.

Four service entrances run from the transformer vault of the Consolidated Edison Company to the main board.

The Esso Building was designed by architects Carson and Lundin. Construction was by John W. Harris Associates, Inc. Mechanical engineering was by Pollak and Grieve. Electrical installation work was by Eastern States Electrical Contractors, Inc. All persons and organizations cooperating in the construction of the building are located in New York City.

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Fluorescent Lamp Fixture for shop, mill, factory

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Operating weight 15 lbs. Reconditioned originally sold for $166.00.

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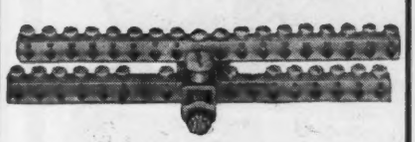

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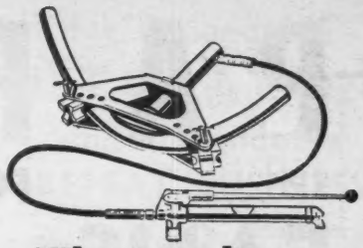

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Onan PRODUCTS *Write for Catalog*

ONAN ELECTRIC PLANTS

SILENT PAGING

[FROM PAGE 69]

consist of two parallel runs throughout with seven conductors in each. This provided ample space for pulling in the conductors and allows additional space for possible expansion in the future.

The wiring between the portable keyboards and the terminal cabinets consists of ten feet of flexible cable provided by the manufacturer of the equipment.

The wiring between the two keyboards and the control panel normally consists of 16 conductors which may be No. 16 gauge. In this installation, a total of 20 No. 16 $\frac{3}{32}$ inch rubber insulated conductors were run between these points in single runs of Wiremold. A small amount of conduit was also run in conjunction with same.

The accompanying partial riser layout shows the relative construction requirements of the two floors.

The system in general operates from 115 volts 60 cycle a-c. This includes all of the lamp annunciators and part of the control panel. The keyboards however, operate on low-tension and are fed directly from the control panel.

All of the molding was finally painted to match with the ceilings and walls, and presents an excellent appearance.

The system, operating silently, is noticeably more desirable than the standard bell installations and, with call numbers visibly presented, errors in paging are non existent.

E. D. Tillson (center), director of Commonwealth Edison Company's lighting laboratories in Chicago, draws envelope sketches to emphasize his discussion with Solar Light Manufacturing executives (L to R) B. Lazerson, J. A. Hodges, and H. M. Lazerson at their Chicago lighting show exhibit.

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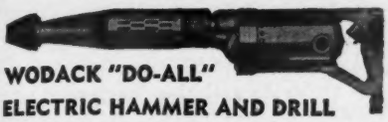

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WHERE TO BUY

Section

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation, maintenance and service. Make a habit of checking this page, each issue.

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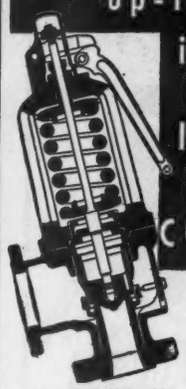

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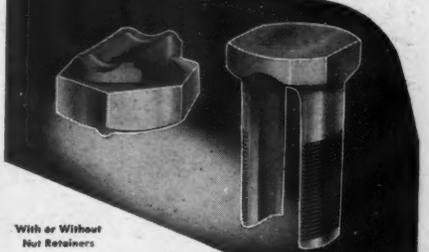

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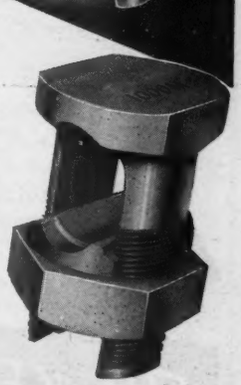
This Sherman Connector assures tight, permanent, ***dependable*** wire connections, without excessive wrench torque, because threads on both body and nut are machine cut, and checked with precision gauges to mate perfectly.



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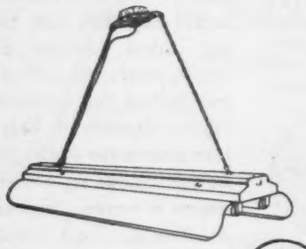
SPLIT BOLT CONNECTORS

HANG CHAIN SUSPENSION FIXTURES IN A FEW MINUTES

WITH HYDEE HANGER*



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*Patent No. D-141024, others pending. Underwriters approved

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TALL REACH WOOD BORER

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This sensational new tool pays for itself (users report) on the first two or three construction jobs. Drills holes through joists, concrete or steel. 11/16", 12/16" or 16/16" and expansion bits with range from ⅞" 2¾" are available. Exclusive all-angle head permits drilling extremely close quarters in any direction. Use for wiring, plumbing or heating installations. No ladders, no more reaching, stretching and straining. Can be furnished with or without adjustable extension. Write for Bulletin No. F.

The KETT Tool Company

5 E. THIRD ST., CINCINNATI 2, OHIO

MEAT PLANT WIRING

[FROM PAGE 79]

sales office, consists of twelve circuits. In this area we installed the four-light, 96-in. Slimline units, again wiring directly from the attic to each fixture. We also provided vaporproof receptacles for general use.

All of the electrical conduits were properly sealed to prevent any condensation. All wire used throughout the building was of RW or TW fabrication.

Installation Factors

It may be of interest to relate a few facts about the installation of fluorescent units in this type of installation. At lower temperatures, the fluorescent lamp light output depreciates rapidly and in the engineering and layout of such a job, great care should be taken to install a sufficient number of lights to compensate for such loss of light. We also have maintained a high level of the voltage by installing only two or three units to each circuit. We believe this to be a very important factor for the successful operation of these units.

The main sales and holding room has a total of 96, two-light units which gives a very well balanced installation and provides 35 footcandles of light. There is less than two footcandle variation in any section of this room. The total connected lighting load in this room is approximately 12,500 watts.

A few other facts may be impressive as to the adequate wiring of the building as a whole. Approximately 9000 feet of metallic raceways of assorted sizes was used, together with approximately 34,000 feet of wire. Wiring capacity, conductor and conduit, for the whole building is for 72,000 watts of lighting.

The fluorescent fixtures, consuming about one-third of the amperage that a comparable incandescent installation would require, represent a great saving to the consumer, both as to his electric bills and refrigeration costs. The estimated saving daily in refrigeration is eight tons, comparable to 12 hp.

Another feature of this type of lighting is in respect to the condition of the meat. Under incandescent lighting of the same footcandles, the meat has a tendency to dry up and look very aged in a few days because of the excess heat of the standard lamps. The fluorescent installation permits a high humidity in the room.